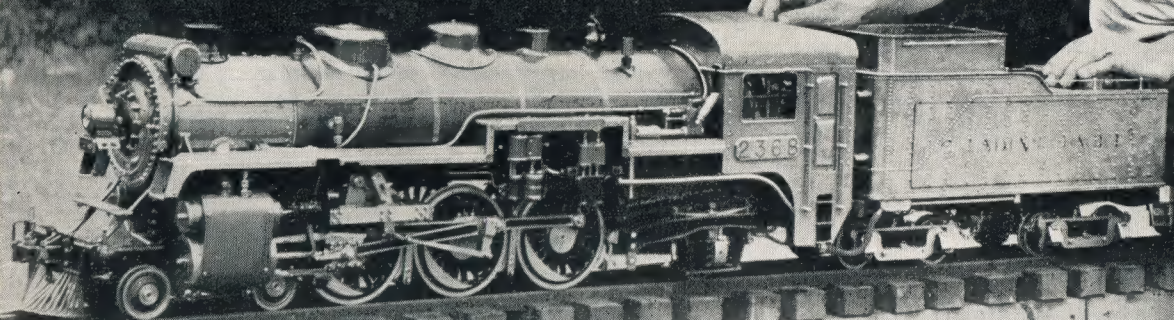


Model Engineer

THE MAGAZINE FOR THE MECHANICALLY MINDED



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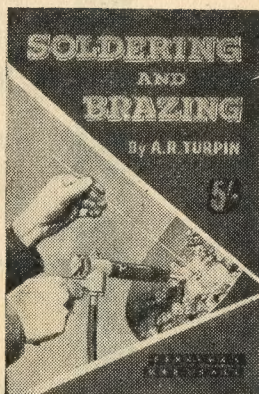
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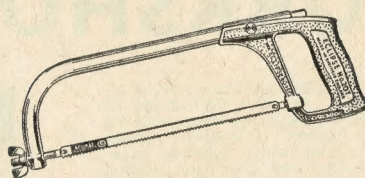
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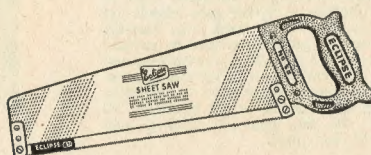


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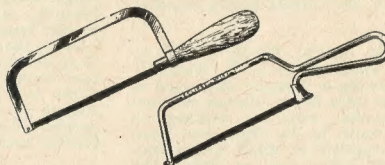
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A WEEKLY COMMENTARY BY VULCAN

H. WINTON, whose experiences with his 2 in. scale traction engine are described elsewhere in this issue, is a member of the Acton Society of Model Engineers and at one time was its chairman.

His traction engine is of free-lance design and of first-class workmanship; the original specification was prepared in 1941 and a complete set of drawings was made. Actual construction began in 1946 and progressed slowly but surely during the following nine years. All patterns and castings were home made.

A light-hearted account of this engine's first steam test was published in ME for 8 March 1956; after certain adjustments were made, as a result of the test, the engine has settled down into the steady performer that it now is.

Meanwhile, it has won high awards at the ME Exhibition and elsewhere.

Gas-turbine locomotives

THERE is a general impression that, while the gas-turbine locomotive is intrinsically an extremely interesting machine, the high cost of its construction and operation, coupled with its liability to failure, preclude the possibility of its being included among locomotives of the future.

There are signs that this idea is fallacious, for there has recently been published a very full report by the American Locomotive Development Committee, setting down in minute

detail the results of experiments with gas-turbines as motive power units.

A point to be stressed is that a number of different types of turbine have been tested, all of them coal-burning.

Ash problem solved

The difficult problem of disposing of the ash which results from the combustion of coal seems now to have been solved, beyond doubt.

With this problem out of the way, the American tests and investigations have led to the production of a coal-burning turbine which is not only thoroughly reliable, but will run continuously for many hours at a fuel cost that is little more than one-third of that for diesel engines of equal power.

So successful have these experiments proved to be that a design has been prepared for rebuilding existing diesel-electric locomotives into coal-burning gas-turbine-electric units capable of taking over the diesels' heavy duties.

The implications of this idea are important; but it is obvious that the proposed rebuilds can only give the most satisfactory results in localities where coal is readily and cheaply available, if there is to be any advantage gained over the diesels.

Will Britain follow ?

Apparently, the advantages to be gained are more than tempting, and it may not be long before one of the

Smoke Rings . . .

proposed rebuilds will be undergoing tests in operating conditions.

In the Eastern States good coal is abundant and—compared with fuel oil—cheap, and it is there that the tests are more than likely to be made.

If they are successful, there seems to be every reason to believe that the present dieselisation programme for British Railways may undergo some modification. Experience with the Western Region's gas-turbine locomotives suggests that these machines would be more satisfactory if their fuel cost could be reduced.

Edible medium

DO you eat your models when, if ever, you have finished with them? I ask this question after meeting Henri Chavaux, who has a Venetian fishing vessel in the Model Engineer Exhibition.

M. Chavaux, a Belgian who has lived in England for fourteen years, is probably unique among modellers in that he first creates a work from orthodox materials and then copies it in chocolate. He happens to be a distinguished chef—at the Cumberland Hotel in London—and his confectionery models have won him national and international awards.

The tower illustrated on this page (how many would guess that it was made of chocolate?) recently gained him a gold medal at an exhibition in the famous Cafe Royal. It stands about 2½ ft high and has no fewer than fifty-six windows.

For a work of this kind M. Chavaux uses the same tools as in building a conventional model, such as his well-detailed vessel in the Model Engineer Exhibition and the lighthouse which he had there a few years ago. The techniques and problems, he says, are much the same. It is, of course, not possible for him to copy everything in chocolate. "I do not think," he told me with a smile, "that ball-bearings made with chocolate would be very effective."

What does this versatile modeller do with his confectionery models after they have been exhibited? The confectionery is perfectly edible but Henri prefers not to eat something which has been exposed to crowds and is also no longer fresh. He, therefore, breaks up the model, and, if possible, uses the chocolate again. But he is quite willing to give a model to a children's hospital if it has been exhibited under cover and is still a pleasure to eat.

The atom ship

FORMATION of the Hawker Siddeley John Brown Nuclear Construction Co. with a capital of £500,000 foreshadows important developments in the application of nuclear power to ship propulsion. Project study is now taking place on a vessel of 60,000 tons or more, this being considered the minimum economic size.

The vessel will probably be a tanker, especially in view of the tendency with tankers to become the largest ships afloat. Unlike the normal cargo ship, which uses derricks or cranes to handle its cargo, the tanker can take on or discharge its cargo while lying in a roadstead, all that is needed being a jetty to carry out the pipes to deep water.

Thus its size is not limited by dimensions of dock gates or dock accommodation. The larger ship can



The chocolate-made tower which gained a gold medal for Belgian chef, Henri Chavaux

travel faster for a proportionate expenditure of power, and thus the many costs due to the time element are reduced. John Brown's co-operation in the project will enable the valuable experience they gained in building the Cunard Queens to be utilised.

The possibilities of nuclear propulsion for tankers were neatly put in a statement by Eric Mensforth, a director of John Brown and of the

Cover picture

This ¾ in. scale Pacific of the CPR can haul 12 adults. It took six years' spare time work to construct. See story about Toronto Society of Model Engineers.

new company, when he said he thought that a vessel that needed no refuelling, has practically unlimited power, did not eat up its own load, and spent only a small proportion of its time unloading was likely to prove an economic proposition. This would make nuclear propulsion especially suitable for tankers.

Bearing good fruit

WITHIN recent years the possibilities of model engineering, as an aid to training in metalwork, have been given a good deal of attention in schools. The ME has endeavoured to help in this movement by providing information on models suitable for construction in school workshops, and advising on methods of dealing with these subjects. Education authorities have recently informed me that these efforts have brought forth good fruit, and the popularity of models is increasing rapidly in secondary and technical schools.

In the past, metalwork teaching has often been confined to the production of uninteresting or hackneyed test pieces, which may have taught pupils the basic workshop processes but often caused them to develop a lifelong hatred for this kind of work. By making models, interest and real enjoyment for the work can be introduced, and in many cases the models can be usefully employed to demonstrate theoretical principles as well.

Encouraging increase

Last year a member of the ME staff gave a lecture to an audience of handicraft teachers in NW London, and from the way this was received, and subsequent developments, it is quite clear that schools will be turning out more "model" pupils in all senses of the term. Incidentally, there has been an encouraging increase in the number of entries for the Student's Cup at this year's ME Exhibition.

An article on the methods by which one master used the building of model locomotives to interest the boys of a Hertfordshire school appears on pages 152 to 154.

2 in. scale traction engine

H. WINTON writes of the joys and pitfalls of driving a road locomotive on the Queen's Highway

INITIAL passenger hauling tests of my 2 in. scale traction engine took place on a rather damp lawn using a child's folding push-chair as a passenger-carrying trailer. An assistant was stationed behind the push-chair with instructions to heave it round the corners.

A piece of rope connected the engine and trailer and a board across the arm rests of the push-chair constituted the driver's seat.

Extreme nervous tension and an acute sense of discomfort permeated my being. All went reasonably well on the straight, but at the first corner, although the engine turned satisfactorily, the attendant was unable to turn the trailer with my 13 stone on it and I became an interference fit in a rose bush.

With this experience behind us we made a number of runs up and down the garden, but a pause to recoil provided an opportunity to survey the landscape and it was noted that a series of deep ruts furrowed the lawn and the grass had in large measure disappeared.

I discovered the hitherto unsuspected fact that a traction engine rear wheel, when slipping, becomes a very efficient milling machine.

It was clear that a properly designed passenger trolley would be essential if one was to carry out worth-while passenger hauling tests, and some venue other than the garden would have to be found.

The drawing shows the general arrangement of my trailer, the capacity being three adults. Unladen it weighs 108 lb. This is quite a lot heavier than it ought to be, and by careful design it could be got down to 75 or 80 lb. There are a lot of considerations which need to be taken into account when designing a passenger trolley.

The position of the seat relative to the footrests should be such that the driver can reach the engine controls without recourse to gymnastics. The height of the seat above the road is also important, as to some extent this dictates the wheel size.

To find a comfortable driving position a scale cardboard silhouette of the driver, jointed at the knees, hips, shoulders and elbows is a great help.

The wheels on my trolley have solid rubber tyres 8 in. $\times$ 2 in., but I would recommend something larger, say 12 in. $\times$ 2½ in. or 12 in. $\times$ 3 in. It is important to keep in mind that the rolling resistance on the level will vary directly with the wheel

diameter, other things remaining constant. That is to say, if the wheel diameter is doubled, the rolling resistance on the level is halved.

If you are running on concrete or smooth tarmac, solid rubber tyres are reasonably satisfactory, but in the absence of springing, pneumatic tyres have a lot to recommend them from the passenger-comfort point of view. For running on turf, I would say that pneumatic tyres 12 in. $\times$ 3 in. are the minimum if a useful load is to be carried, but the rolling resistance on turf is very high compared with that on concrete or tarmac, and similar hard surfaces.

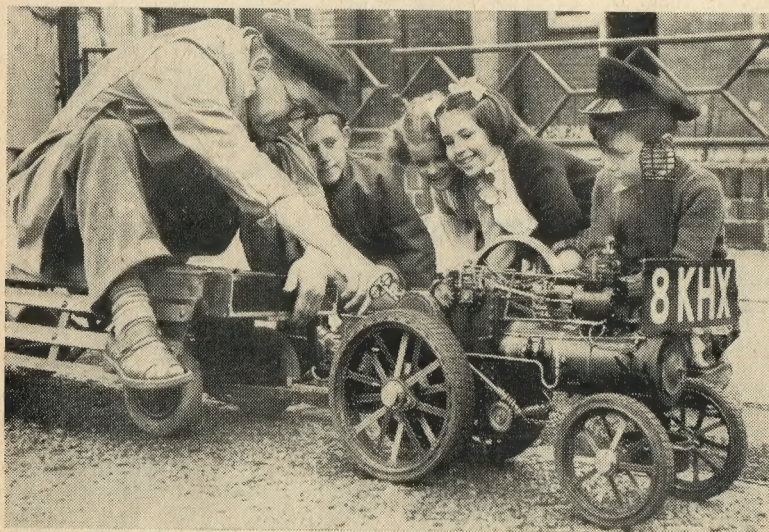
The rolling resistance of my unladen trolley is 3 lb. on concrete, 5 lb. on fairly rough tarmac and granite chips, and 9 lb. on short firm turf. The level rolling resistance will, of course, vary directly with the total weight. Needless to say, ball or roller bearings are of benefit, but the nature of the road surface has more effect than the type of wheel bearings. Solid rubber tyres are rather heavy and, size for size, pneumatic tyres will show an appreciable saving in weight.

Manoeuvring

To facilitate manoeuvring in confined spaces, and to simplify construction, I advise cart type steering on the trolley, the front axle being free to turn through 360 deg. about its central pivot. It will also be necessary to provide it with a horizontal pivot to allow it to ride over unevenness in the road surface. The front wheels should be kept close together to permit this tilting action to take place without the tyres rubbing on the underside of the trolley's platform.

Especially when operating on public roads, a brake is essential. Wooden blocks rubbing on the rear wheels seem to be quite effective, and at the speeds, pressures and frequencies with which they are applied they do not result in heavy tyre wear. Foot operation leaves the hands free for steering and throttle controls.

Even a 2 in. scale engine carries very little water in its tender in relation to its consumption. Mine holds a quart and as it uses this up in about 15 minutes I have a two gallon tank on the back of the passenger trolley. This feeds via a rubber pipe to a manifold on the back of the



The author with his traction engine, under scrutiny by youthful enthusiasts

[Photo: Acton Gazette]

Traction engine . . .

tender, to which are connected the feeds for the engine-driven pump and the injector, the actual tender tank not being used at all.

A hand pump was originally fitted in the tender, rather like a blowlamp pump, but now that I have overcome various little development troubles I find the hand pump is unnecessary and it has been removed. In any event, if both the engine-driven pump and the injector failed, one can always drop the fire.

As originally fitted, my towing arm connections on the back of the tender was above axle level. A moment's consideration should have told me what would happen but I failed to anticipate the consequences and I was disconcerted to find, on my initial test runs, that when going uphill with a heavy load the engine would suddenly rear up on its rear axle like a frightened horse. The towing connection was lowered and the trouble ceased.

A spring coupling in the drawbar

controls with reasonable comfort; a brake is necessary; a total number of three adults including the driver seems to provide a reasonable maximum load.

LICENSING

Several minor modifications to the engine were necessary in order to adapt it for serious passenger hauling, but before I go into this I should like to write about the licensing of model traction engines for running on the public roads. Contrary to what I had anticipated this turned out to be a simple matter and not very expensive.

I wrote to the local motor taxation department and explained the position very frankly, quite expecting to be told that the tax would be some astronomical figure completely outside my reach. In fact I had even gone so far as to think up some pungent phrases to be used in my reply. I was, therefore, very pleasantly surprised to receive a courteous and helpful reply which resulted in my model being licensed as a tractor at £2 per annum, the same as is paid in respect of a farm tractor.

It is, of course, necessary to take out a third party insurance, but this cost me less than a pound so that for three pounds a year I can run on any public road and thus have a far

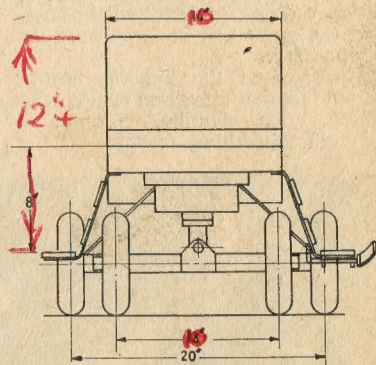
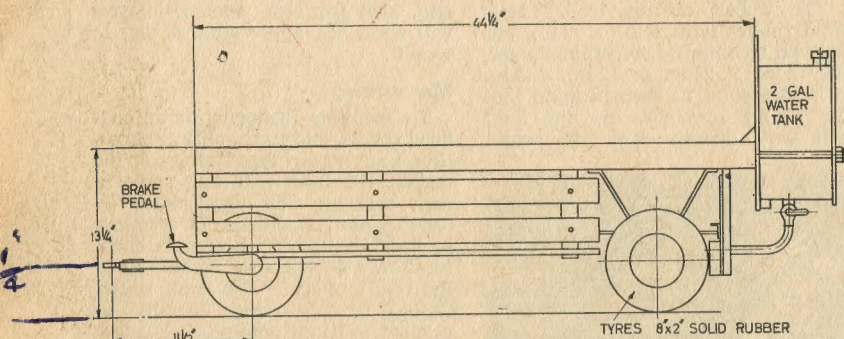
brakes and kindred matters. Number plates, unfortunately, have to be of the same proportions as for full size tractors and motor-cars. I asked for a concession to use motor-cycle size but without success and this accounts for the front view of my engine looking like a square-rigged ship.

ENGINE

My engine is a Fowler of 1½ in. bore and 2 in. stroke. The top gear ratio is five to one and low gear eight to one. These ratios are very different from those of the full-size engine which were of the order of 15 to one, and 30 to one respectively, but scale effect enters into this.

If the full size ratios were used it would result in far more torque being available at the back wheels than could possibly be made use of, since the wheels would slip, even though rubber tyres were used, long before the engine exerted its maximum power. As things are, my engine—when developing full power with a boiler pressure of 100 p.s.i. and cut-off at 70 per cent—develops a maximum drawbar pull of 75 lb. in bottom gear, and I estimate that it could not use much above this without the wheels slipping, particularly on concrete or smooth tarmac.

I should add that the engine weighs



General arrangement of the passenger trailer

is essential in order to obviate snatch when starting, and with heavy loads it is essential in order to get going at all since, owing to lack of momentum in the flywheel, the engine stops on dead centre.

A box of about 2½ in. × 2½ in. section running transversely across the front of the trolley makes a convenient stowage for the fire irons and oilcan, etc.

I feel that the most important points about trolley design are: wheels to be as large as possible consistent with the driver reaching the

wider choice of running track than is usually available to locomotive fans.

This freedom of choice, however, needs to be used with discretion and I have no doubt that any attempts to traverse busy roads for any distance might well result in a summons for obstruction.

Before putting the engine on the road, it must comply with the Motor Vehicles (construction and use) Regulations of 1955, copies of which are usually available from public libraries. This refers to such things as the necessity for fitting rubber tyres, design of

122 lb., of which about three-quarters is on the back axle.

The first modification to the engine was to fit solid rubber tyres to all four wheels. The spaces between the strakes on the back wheels were filled in with strips of hardboard (drive fit) and the periphery trimmed up with a rasp.

With the aid of an adhesive called Evostik I stuck two thicknesses of rubber, each about 3/16 in. thick, around each wheel, the joints being simply butted. Over these was stuck some rubber strip, which is sold for

boot and shoe resoling. It looks like, and probably is, the centre tread portion of cycle tyres which presumably are factory rejects.

This strip material is, of course, canvas backed and I found it necessary to roughen it very severely before it would stick sufficiently well for my purpose. I think the trouble probably arises from the presence of french chalk and I advise anyone using this material to remove as much of the canvas as possible without damaging the rubber.

Tyres made up in this way have had some pretty rough treatment meted out to them, including wheel spinning on gravel paths, but the adhesion is still seemingly 100 per cent. Of course, the function of the two $\frac{3}{16}$ in. strips is to absorb some of the road shocks, so it needs to be of a suitable hardness; somewhere about the same as that of cycle outer covers seems reasonable.

Tyres are quite important things on a road-going engine. The majority of traction engines are, I understand, unsprung, and since the humps and hollows of the road are not scaled down, the engine can receive some quite hefty jolts on what, even from a bicycle, seems a reasonably smooth surface.

My tyres are just over $\frac{1}{2}$ in. thick and give quite good shock absorption when compared with the results obtained with only very thin rubber strips designed to give road adhesion only.

On the assumption that a water tank is fitted on the passenger trolley, the plumbing of the engine needs to be rearranged. To avoid wasting feed water, I arranged for water, which would otherwise be returned to the tender tank when the pump bypass cock is opened, to be fed back into the pump suction pipe. The injector water feed was rerun to connect with the manifold on the back of the tender.

Firing

Firing needs to be carried out rather frequently. It cannot be denied that since the engine is not provided with a superheater, it is not so efficient as it otherwise might be, and in addition it probably runs at a fairly high proportion of its full power output for longer periods than a railway locomotive. On an average it requires a generous shovelful at intervals of about 70 yd or so.

As all locomotive men know, it is advisable to get the fire-hole door open, the coal in and the door shut again in the minimum possible time, if an excessive amount of cold air is not to be drawn through the fire tubes, and this operation is not made easier if the driver has to steer as well as stoke. The fire-hole door on

a traction engine is less accessible than on most railway locomotives, which makes the operation doubly difficult.

I, therefore, modified the fire-hole door latch by adding an extended handle consisting of a piece of piano wire extending to the coal division in the tender and joined to the latch by means of a universal joint. This, in conjunction with a long-handled shovel and considerable practice, has greatly facilitated the operation of firing.

The floor (or is it called the foot-plate?) in the area adjacent to the fire hole is removed, since it was found that spilt coal invariably jammed the fire-hole door. Spilt coal now falls through into that black sticky pit between the tender and the back of the fire-box which houses the back axle and from there it either falls through on to the road or is retrieved during cleaning up operations.

With the steering geared for quick response, the worm gear is on the point of being reversible, and this becomes a nuisance when the driver lets go of the wheel during firing. I have overcome the trouble by fitting a small steering damper. As a point of possible interest, my steering gear gives 5 deg. of movement of the front axle for one revolution of the steering wheel.

There is little point in having a very small turning circle since, when the trolley draw-bar approaches an angle of 90 deg. to the fore and aft axis of the engine and particularly if the engine happens to be pulling hard, there is a high sideways force put on the front wheels which causes them to slide sideways. This is liable to happen on turf. In any case, with a necessarily short draw-bar a very small turning circle brings the engine rear wheel into conflict with the footrests of the trolley.

Raising steam

With regard to steam raising, model railway locomotive technique applies. I use an electric blower with its inlet pipe pushed down the chimney. When away from my home base I use a hand driven generator clamped to the side of the passenger truck. The engine blower is of the ring variety with three No 65 holes.

Typical times for raising steam are: from cold to 10 or 15 p.s.i. on the electric blower in about five minutes, and from this point to 100 p.s.i. in a further two or three minutes, using the engine's own blower.

The outer chimney contains a liner or false chimney which is $1\frac{1}{8}$ in. dia. at the top and widens to the full diameter of the outer chimney at the base. Early steam tests soon showed

that the exhaust blast would not fill the outer chimney (2 in. dia. at the top) although it was made strictly to scale. The exhaust blast nozzle is $\frac{3}{16}$ in. dia.

I imagine that the full size engine is not entirely dependent upon artificial draught.

The steaming powers of the boiler are good. It maintains 80/90 p.s.i. under nearly all conditions. It will drop a little when going down hill with the throttle nearly shut. The safety valves lift at 100 p.s.i. when going up hill with a load, unless the fire door is opened or the damper shut.

Most full-size traction engines and road locomotives have their blower control valves situated on the smoke box or cylinder casting. I think it was Frost Spike in MODEL ENGINEER of 1926 or thereabouts who said that this was done to discourage careless stoking. However, in the interests of greater driving convenience, I modified this control to provide a control wheel in the driving cab.

When running into a strong head wind one occasionally receives the flue gases full in the face, and on damp days the exhaust steam condenses as it leaves the chimney and occasionally interferes with the driver's vision. I haven't yet found the answer to this.

A chimney extension sounds the obvious one, but it needs to be about two feet high to be effective and this would look completely out of scale and would need some external support in order not to strain the chimney bottom end fitting.

Gets in one's hair !

It may be that a small deflector in the chimney top might be made to give the exhaust a slight sideways deflection. Small pieces of hot coal in one's hair are sometimes a little painful when they penetrate to the scalp and I have recently fitted a wire grid on the top of the chimney and this reduces the size of the pieces which escape and I can strongly recommend this as a worth-while fitment.

The governor pulley sizes and spring strengths are designed to keep the crankshaft speed to approximately 500 r.p.m., which gives a road speed of 2 m.p.h. in low gear and $3\frac{1}{2}$ in top. Considerably higher speeds than this are possible with the governor disconnected. I have travelled at 10 m.p.h. on a very smooth surface in a school playground, but this is most unfair on the engine.

In my opinion, for an unsprung engine of 2 in. scale, 2 m.p.h. on other than a very smooth surface is about as high a speed for continuous driving as one should use. About

● Continued on page 175

A 60 c.c. HORIZONTAL GAS ENGINE—2

EDGAR T. WESTBURY makes
a start with the machining
of the main structural parts

Continued from 18 July 1957, pages 73 to 75

IN PRESENTING any design for construction by readers of the ME, one of the primary considerations is the facility for carrying out all necessary operations with the limited equipment likely to be found in the average amateur workshop.

This matter is never neglected in the engine designs which I describe, but it is of special importance in the present case, because the size of some of the components of the engine is such as to create difficulties for handling when the only machine tool available is a lathe of $3\frac{1}{2}$ in. centres. It is quite obvious that in spite of all efforts to avoid excessively large single castings in the design, some of them are too large to swing on the lathe face plate, and improvised methods of dealing with them must be devised or, where possible, the necessity for machining avoided.

As the design is highly adaptable, it is possible for constructors to incorporate their own modifications in some of the details, so as to simplify these problems still further.

BASE PLATE

In some cases, the particular form of base plate (part No 1) shown is not necessary, as the engine could be mounted on any solid base such as a block of wood or concrete, or a fabricated metal frame. If, however, the cast base plate is adopted, the problem of machining it arises; but where access can be obtained to a large lathe or, better still, a planer or shaper, this matter is easily disposed of.

But many readers will be unable to obtain these facilities, and for their benefit the design is arranged so that machining can be dispensed with. All that is necessary is that the mounting

surfaces should be reasonably flat and true, and this can be obtained by filing the edge of the underside, and the four bosses on the top surface. For this operation, a non-clogging file, such as a Dreadnought or the more modern Surform, or Tresa files, can be recommended.

The flatness of the surfaces should be tested on a surface plate; or if this is not available, a sheet of heavy plate glass, mounted on a bed of melted pitch so as to relieve it of uneven stress, forms a very serviceable substitute. It is not necessary to produce the sort of precision surface on the casting that one would associate with machine tool slides, but all trace of rocking must be eliminated.

If the engine is to run on gas only, it is not necessary to use the base as a fuel reservoir; but, otherwise, the orifice for the filler cap must be drilled and tapped, and the bottom closed by a sheet metal plate. A cored hole will probably be provided in the filler boss and will only need enlarging, by reaming or even filing, prior to tapping either BSF, gas thread, or any thread for which a tap can be obtained. The top surface may be spot faced, but as it does not have to make an airtight joint, it will be sufficient to file it reasonably square with the axis of the thread.

The bottom plate may be welded in, if means are available; but I have found it quite satisfactory to cement it in place, in the same way as glass

panes are fixed in a window frame, so long as the cement is of a type which is not dissolved or destroyed by the fuel. Some of the modern plastic cements fulfil this condition, the best I have tried being Bondafiller; Loy is satisfactory for petrol or paraffin, but may not be proof against more potent solvents, such as benzol or similar blended fuels.

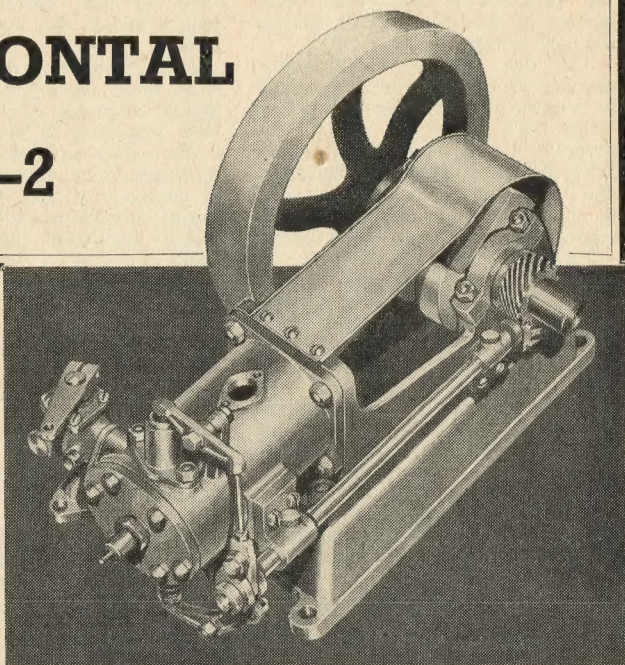
The plate should be fitted as closely to the inside of the rebate as possible; it may be necessary to scrape or chip away any obvious roughness in the casting, after which the plate is bedded in on a thin film of cement, and a liberal fillet then built up on the underside as shown.

It will be noted that the dead flat bottom of the tank will not allow of using up every drop of fuel by suction feed; but, if desired, a small well may be formed in the plate, immediately under the suction pipe, which will, of course, have to be lengthened accordingly.

BODY CASTING

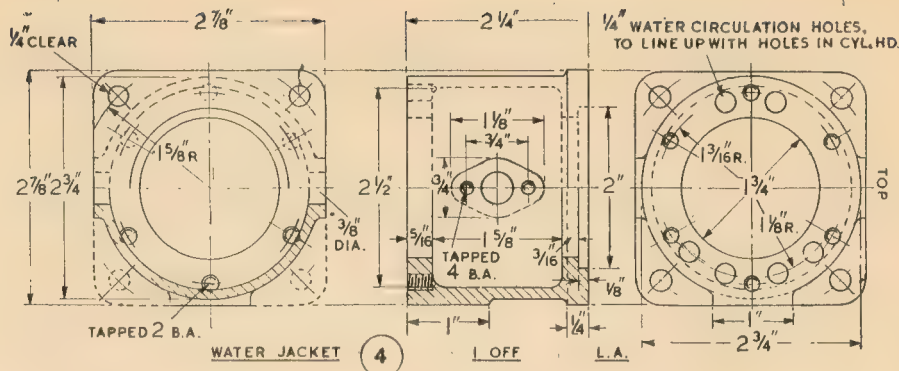
The underside of this casting (part No 2) may be filed flat as in the previous example, but machining is essential on other surfaces, and this can be done by mounting it on the cross slide of the lathe. Before doing so, however, it is advisable to fit the bearing caps (part No 3) and fix them in position with temporary screws.

The inclined surfaces of the seatings on the body casting may be filed true,



60 c.c. GAS ENGINE

continued



and cylinder seating is desirable, but this need not be elaborate, and I have not generally found it necessary to provide more than a check-up on these locations. The casting should first be set up with the sides parallel to the edges of the cross slide, and adjusted so that the bearing centre lines up with the lathe axis; it is advisable then to tighten the slide gibs so that inadvertent movement is prevented.

The bearing housings have purposely been made large in diameter so that a boring bar of adequate rigidity will pass through them, but if any difficulty in this respect is encountered, preliminary opening-out of the holes can be done with a drill held in the lathe chuck, so long as this is followed by a cutter bar supported at the tail-stock end. The sides of the housings can be faced by means of side cutters mounted in the bar, care being taken to finish them square with the bore. On the timing side, the facing for attachment of the camshaft bearing may be machined with a fly cutter or face mill.

The casting is now swung round on the cross slide to a position at right angles, with the vertical flange now facing the lathe headstock. It can again be held down by the strap across the waist, though the bolt hole positions may have to be readjusted, and the squareness of the setting must be carefully checked. The best way to do this is to mount the face plate on the lathe mandrel, and fit a straight, stiff bar through the bearing housings, clamping it if necessary by the bearing caps. With the saddle locked, measurement between the face plate and the ends of the bar will enable the casting to be set exactly square.

After centring the cylinder seating, it can be bored with a cutter bar held in the chuck, or a boring head if available; the latter is also useful for machining the face, as it provides radial traverse for the cutter. In its absence, however, the best way to deal with the facing operation is to use a fly cutter, and traverse the work by

means of the cross feed. This is preferable in some respects, as it enables the cut to be finished in a horizontal line parallel with the base flange, instead of in an arc as with the boring head.

It will be appreciated that by a little forethought in design, a component which might have been very difficult or complicated, both to cast and machine, has been simplified to the utmost without impairing its functional efficiency.

WATER JACKET

This (part No 4) is quite a simple casting to machine, as it may be held in the four-jaw chuck at the head end for facing and boring, also recessing for the packing ring, at one setting. The other end face should preferably be dealt with by clamping the job to the face plate, either over the corners of the square flange, or by drilling the holes in same and fitting bolts. By this method, the end forces are bound to be exactly parallel—unless the face plate runs out of truth! Exact concentric setting, of course, is not important.

The faces of the top and bottom flanges for water connections can be machined by mounting the casting on an angle plate, by a bolt through the centre; the side face for the camshaft bearing may also be dealt with in the same way, but note that this is intended

to line up exactly with the seating for the other bearing, on the body casting, so the operation may well be deferred until the parts can be temporarily assembled for checking up on alignments.

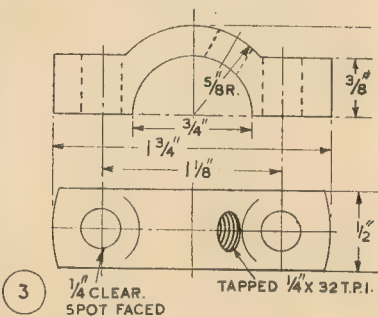
CYLINDER LINER

If possible, a centrifugally-cast sleeve should be used for making this; apart from the quality of the material, such castings usually have a fairly heavy flange which can be held in the four-jaw chuck, enabling all the most important machining to be carried out at one setting, and without risk of distorting the thin section by chucking pressure. The inside can then be bored by a heavy cutter bar or solid tool, taking care to ensure that it is parallel, and as well tool-finished as possible, leaving about 0.002 in. for lapping or honing.

After facing and chamfering the mouth of the bore, a centred plug may be fitted to enable tail-stock support to be used while machining the outside to a close push fit in the bores of the water jacket and body castings. Finally the lip is turned on the outside diameter and the liner is parted off. To true up the end face, mounting on a mandrel is best, but as it may be difficult to find a mandrel this size, the job may be held by the outer end in the chuck, with a fixed steady near the other end, for this light operation.

Methods of finishing cylinder bores have been described so often in the ME that one would think it hardly necessary to dwell on this matter, yet the number of queries about it indicate that many readers find difficulty in producing accurate results. Lapping, however, is a quite straightforward operation, demanding more of patience than of actual skill; it cannot be hurried, and the time involved in carrying it out will depend on the amount of metal which must be removed in eliminating errors in roundness or parallelism, tool marks, or dimensional discrepancy.

● To be continued



Bearing caps, 2 off, L.A.

OBTAINING accurate gaps with square edges on piston rings, and refitting pistons to cylinders straightforwardly and without damage to rings, are two problems likely to be encountered in engine overhauls. The problem of removing rings from pistons and refitting—which should always be done from above, not down the skirt—except in the case of rings in the skirt—is, of course, solved by using three strips of thin metal to bridge the grooves in pistons.

Before being filed for fitting, rings should be tried in their cylinders, well down towards the centre, and if necessary squared by pushing the pistons behind them. It will be seen if there is clearance at the gaps—and, if so, a check can be made with feeler gauges. Otherwise, a preliminary estimate must be made of the amount to be filed.

BEGINNER'S WORKSHOP

By GEOMETER

Fitting piston rings

there is a risk of breaking thin rings; failing a good vice, two pieces of flat steel plate can be used as clamps. The file must be a fine cut pattern, in good condition, for minimum pressure to be applied in working.

The advantage of a jig over free-hand working lies in the facility with which accuracy can be preserved at the edges forming the gaps of rings.

Having been filed, rings are tried again in their cylinders, the gaps checked, and these, if insufficient, increased by further filing—a process taking considerable time in the case of a multi-cylinder engine, since whether working free-hand, or using an orthodox jig, it is not known how much has been removed from rings at their gaps.

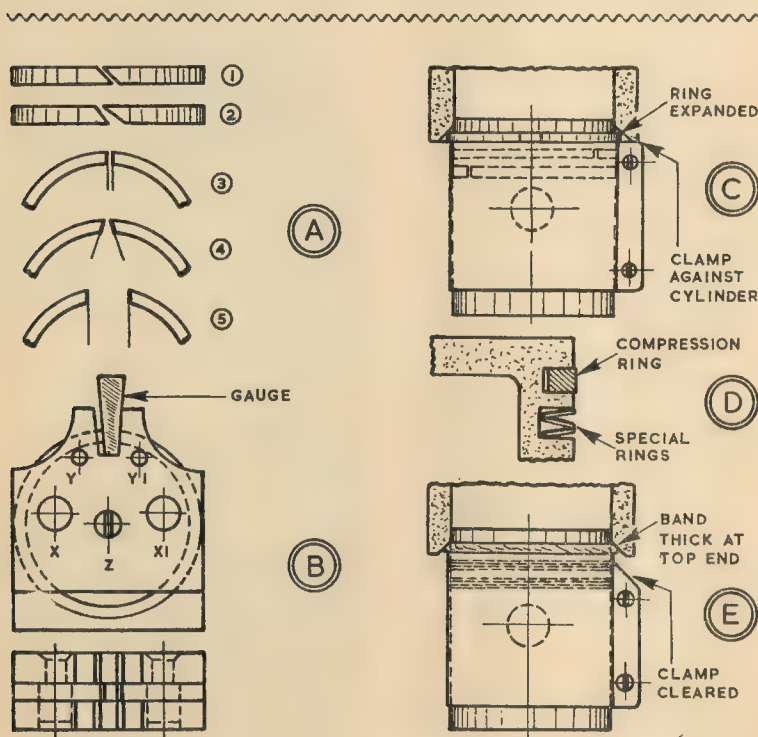
Employing, however, the special type of jig and gauge, as at *B*, once a ring has been tested and the amount to remove discovered, work can proceed on this and other rings of the same batch, to give the required gap(s) at a single filing of each.

For butt-joint rings, two pieces of equal-thickness steel plate are located by stepped dowels *X-X1* with smaller dowels *Y-Y1* to support the ring near the gap. A countersunk screw *Z* provides preliminary clamping, then the jig is held in the vice.

The slot for the file should be tapered to avoid the effect at *A4*; and the gauge should be about 0.015 in. narrower—this being the maximum amount removed at a single filing, but which can be reduced using a feeler gauge in with the gauge. In setting up, the ring is gripped to the gauge, this pushed to one side of the slot, then the screw tightened. Only the amount of ring projecting can be filed away.

For scarf-joint rings, the slot must be angled; and except if rings of only one width are filed, a thick piece of plate should be used for the guide, and a thinner piece, cleared in the slot, for clamping.

Because of restricted space, entering rings in cylinders of car engines from below usually requires a ring compressing device consisting of a band and clamp. With wide rings, this is successful; but with narrow rings, an effect as at *C* can occur—the clamp contacting the cylinder and pushing down before the ring has entered. This is the main difficulty in fitting special laminated rings, as at *D*, and is overcome by clearing the clamp, and thickening the top outside of the band with a ring of solder, chamfered to fit the cylinder, as at *E*. ■



For filing gaps of rings, there are various types of jigs, though often rings are simply held in a vice with only small portions near the ends projecting, and the edges filed to provide clearance. The vice must be an accurate smooth-jawed type, or

From the side, the edges should be parallel, as at *A1*, not diverging as at *2*; while, from above, parallelism should again obtain, as at *3*, avoiding an effect as at *4*—which can occur when a ring is closed after parallel filing in a well-opened attitude, as at *5*.

MODEL ENGINEERS AT SCHOOL

NORMAN PENSAM recounts his trials—and triumphs—in introducing model engineering to the younger generation at Norton Secondary School, Letchworth

READERS may recall that in January 1956 *MODEL ENGINEER* published an article in which I gave my reasons for building a 3½ in. gauge locomotive; this was done as part of the school metalwork course.

As a result of this article I received many letters. One of the most interesting came from Japan, where the writer is a technical college teacher who plans to do as I am doing. From this correspondence it is clear that many teachers feel that model engineering is desirable, but few get sufficiently encouraging results to persist with it.

I shall deal with the difficulties later, but I am convinced from my own experience that model engineering is a valuable educational medium, and its use should be encouraged in every possible way.

First, I should like to define what I mean by model engineering, for there are two distinct activities which are covered by this term. The more usual meaning is that of reproducing to scale size some fine example of full-scale engineering. The success of the undertaking is judged by the amount of accurate detail included.

Prime purpose

On the other hand a considerable number of people make small versions of power units which may superficially represent some prototype. The prime purpose, however, is to give the builder the satisfaction of making it and, later, the pleasure of running it.

The first kind may have educational applications, but it should not be considered for secondary schools. The class of workmanship seen in the exhibitions is clearly beyond the ability of boys of this age group (11-16 years). This fact may account for the present situation, where there are many well-equipped workshops in schools but little in the way of model engineering in them.

What may not be appreciated is the fact that it is the working model and not the finer points of scale that

appeals to boys. They are capable of making quite complicated ones if the work is broken down sufficiently, and the need for very fine limits is avoided. The choice of work is wide, though I personally recommend Live Steam.

As a nation we learnt to be engineers by perfecting the steam engine, and it is the best way of teaching engineering to youngsters. Great accuracy is not required, the adjustments are not critical and the mechanism comprises a large number of fairly simple parts.

If suitable water is available, steam-powered launches should form a sound basis for developing this type of work. Then there is the stationary engine. But once made it does not "do" much. The traction engine has, I know, been used as a model in school. It has much to recommend it, being self-contained and capable of passenger hauling, but I do not think any boys in my school have ever seen a full-size one! Finally, there is the railway locomotive. This has the greatest appeal of all steam models, but there are two big disadvantages: the necessity for a track and the difficulty of making the boiler.

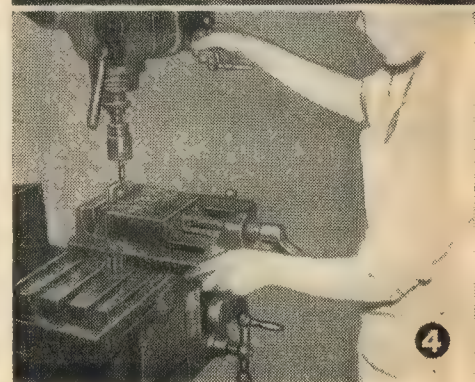
I should like now to "recap" on my previous article concerning our first locomotive, the *Juliet*, which we named *Wendy*. The parts for this engine were built by boys of 12, 13 and 14 years of age, the work being done as part of their metalwork

1 *The critical moment! The boys open the mould containing the pattern they have made for the engine casting*

2 *The NORTON MAID'S first public appearance. Senior boys operate the locomotive at a charity fair*

3 *A third-year boy marking out a buffer beam*

4 *Fourth year boy using a vertical miller for accurate drilling on the ball-race housings for the passenger bogies*



course. The older boys did the more difficult work and I finished the final brazing of the boiler.

When this had been going on for about nine months, and it was clear that it would be successful, I got from an old scholar the frame, wheels, and various other parts of a 5 in. gauge *Maid of Kent*. It all seemed enormous compared with *Wendy*, but I started the boys on it to see how they would manage on this larger gauge.

I think on the whole it was a good decision although we were left with all the difficult bits—and inside motion Stephenson link can be difficult! The experience, however, has left me convinced that 5 in. gauge is the best for school work.

Three main activities are carried on simultaneously: art metal (copper-work) forgework, with some casting, and engineering. The last activity is now almost entirely concerned with the locomotive. For the third year classes the three groups are changed each term to give everyone experience of them, and the fourth year is allowed a choice of work in these groups.

The second year boys are normally doing an introductory course of elementary work. But occasionally an opportunity arises for giving them some simple items from the locomotive.

The works of the "Maid" were completed fairly quickly and the tender was started from scratch. It has been built entirely from the resources of the workshop. The wheels are c.i. cast by us from two patterns, one borrowed and one made by a boy.

This metal was smelted in a crucible in our gas/air furnace (inside dimensions 9 in. high $\times$ 6 in. dia.). These wheels will not bear close examination, but they will certainly last the lifetime of the tender. It seems an extravagance to have all that expensive brass to hold $1\frac{1}{2}$ gallons of water and a few pounds of coal. But I could not see a cheaper—and simpler—way of doing it, so brass it is!

Work on the boiler started easily enough. Mild steel plates were cut to shape with the help of a small oxy-acetylene cutter and filed up for flanging the various boiler plates, and the flanging itself was carried out successfully after numerous annealings. The various parts were rapidly completed, and the formidable and expensive collection of copper was assembled, partly by silver soldering and partly by bronze welding.

Most of this I decided to do myself.

Fitting the fire-box stays was done by boys of various classes. Several threads were stripped during the riveting, largely because of the awkward shape of the deep, narrow fire-box. As a result of this soldering has

had to be depended on for watertightness—and has been a continual source of trouble since.

The various boiler fittings, being mostly small turning jobs, were steadily accumulated and fitted. These form excellent practical exercises, and I was pleased to note that a higher standard was achieved than on the previous engine. (It is an advantage to have the earlier work for new classes to see and try to improve upon.)

Worked directly from drawings

During the time that the "Maid" was under construction the blueprints covered most of my available wall-space. Having had some of the detail explained to them, the boys soon became quite conversant with the drawings, and worked directly from them. This formed a very practical application of their technical drawing lessons.

Under the drawings stands the engine table, which carries the locomotive, in course of assembly, and its various components. Also on the table are some passenger truck bogies under construction, and some parts of a *Tich* which have been passed on to us. It was started by a young man just out of his apprenticeship, who was killed before he could finish it. His work is so good that I am keeping it until I have some one who can do justice to it.

When the boiler was tested numerous leaks developed—due largely to the stripped stay threads—despite the solder. And so began the infuriating game of "chase the leak." When these were cleared, the engine was tested on the 80 ft track we have made at school. Once again the boiler gave trouble by priming furiously. So serious was this that the boiler ran dry on a short run. Of course, all the leaks reappeared—worse than ever! I should have realised that the water was "foaming" seriously, but I was told that all new boilers prime, so I had an outsize handpump made and pressed on.

While I struggled with the boiler, which developed every known trouble, work continued on tender, pump, lubricator and superstructure. The axle pump on the "Maid" with inside motion is quite a difficult piece of work when fabricated, and I was relieved when it was fitted and working. It made it easy to steam the boiler, and it was found that the use of rainwater and frequent "blow-down" reduced the trouble to manageable proportions.

With two engines built, I should like to sum up my experience of this type of work in school. I introduced it because I was not satisfied with the results I was getting in my attempts to

teach the craft of "fitter-turner" (I wish there was a name for the skill of a good model engineer). As I have stated, there are three main groups of metal-working activity which I endeavour to teach in order to give the basic skills and understanding of the main constructional processes.

The making of garden tools, domestic utensils, cycle accessories, etc., form the backbone of the school metalwork course, and it is simple to design jobs that cover the use of the main tools and which are useful either to the boy or his family.

There are some boys who do not get past this kind of work. For those who do, there is the fascinating craft of hammered copper—or silver, if they can afford it! There is a wide choice of work in this field, and I have had quite good results.

On the other hand I found difficulty in finding objects which require accurate fitting and turning, which are interesting in themselves and not just exercises. It was to meet this need that I turned to model engineering, and now I am never at a loss for a job for a boy whatever his age or ability.

Raising the standard

An aspect that I had not foreseen was that an engineering project of some difficulty is being attempted in the workshop by the pupils and myself. This creates a very healthy atmosphere which influences the whole of the work and helps to raise the standard all round. The main disadvantage is the long time it takes for the result to emerge. This can be offset to some extent by the fact that engines already made are still in the workshop, where they can be demonstrated and steamed regularly.

So much am I convinced of the value of model engineering in school that I have designed a 5 in. gauge locomotive to be made by the boys now in their third year. This is an attempt to identify the work with a smaller group than hitherto. I plan to get the main work done by the time this form reaches the end of their fourth year. Owing to the delay on the "Maid" this gives them about 18 months.

My design is aimed at a locomotive that is easy to build—to obviate the difficulties we have had so far and to reduce the amount that I have to do. It is not possible to eliminate this altogether. There are some assemblies—valve gear is an obvious example—which could only be done by exceptionally gifted boys. During the whole process I treat the boys engaged on this work as though they were apprentice model engineers, using my judgment of them in assessing just what work I can give them.

Model engineers at school . . .

I think it is important to appreciate that I had no previous experience of model engineering, and my approach has been entirely from the educational angle. A teacher must not judge boys' work from an adult standard; many adult model engineers tend to be impatient of youthful efforts.

My design will have a steel boiler for cheapness, a wide fire-box to simplify construction, and outside cylinders with Baker valve gear to give a lot of simple pieces. The simplest wheel arrangement I think suitable is 0-4-2—in fact, *Maisie* without the bogie. The Baker gear has been scaled-up from LBSC's *Juliet*.

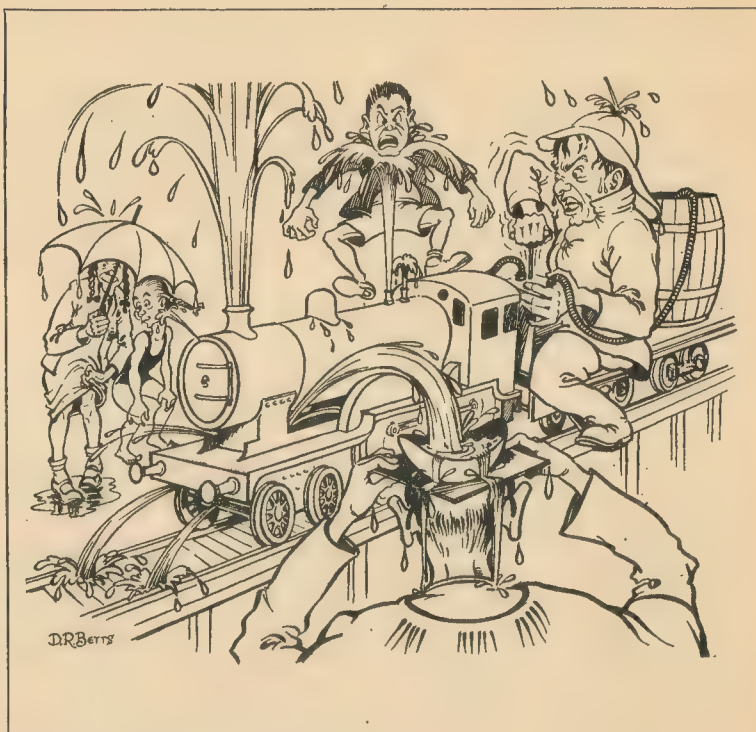
The boys have made a pattern for the cylinders and have cast three. One is a "waster," having sand washed into the mould when pouring. The castings are the first we have made using a core. The pouring of a casting in this size in gunmetal is quite an event in the shop, the mould being prepared by whoever happens to be in that group at that time.

One of the trailing wheels has been turned from the solid, and a start made on the main axles. Next I hope to give each boy a piece of Baker gear to make as a filing exercise. In addition to this older pupils are making passenger trucks, using cast Dural wheels, 1 in. × 1 in. angle frames and sprung axle boxes sliding on $\frac{1}{4}$ in. m.s. rods.

The fourth year classes have also been very helpful in preparing drawings during their technical drawing lessons, for the third year locomotive.

A public appearance

Despite all the trouble experienced *Norton Maid*, as she is now named, has proved to be a good worker.



"I was told that all new boilers prime"

She recently made a public appearance at a charity fair, one of the most popular local events.

On a 120 ft portable track, the engine hauled about 350 passengers in 2½ hours' steaming. (This number would have been much larger if we had had another engine in reserve and if our passenger trucks had not become temperamental.)

The track was lent to us by the Hitchin and District MES, whose members have been of great assistance to me since I started this work.

The erection of the track, the firing,

driving, passenger loading and dismantling were done by boys—with girls at the pay desk.

An event of this sort, entailing a considerable amount of work, is good training in public service. It also provides an opportunity to show that these locomotives are real engineering projects and not mere toys.

In conclusion, I hope this will encourage the younger boys to take this work seriously, so helping to bridge the difficult gap between school and work. ■

SOLDERING OF STAINLESS STEEL

A new and efficient patented solder paint for speedy hot tinning of stainless steel has been developed by the Research Laboratories of Perdeck Solder Products, Waltham Abbey, Essex. Known as "Epatam 3311" Code PLF.73/11, the new product effects tinning and soldering of stainless steel simply and easily.

Possessing high degreasing and penetration properties, PLF.73/11 also effectively tins through iron welding

scales, rust and grease, depositing a bright tinning, thereby overcoming many other soldering problems in addition to its major feature for use on stainless steel.

The increasing usage of stainless steel in industry prompted this development of a material to simplify and improve on existing methods. Conventional soldering fluxes do not facilitate effective wetting of stainless steel by soft solders or tin; in fact,

anyone who has used these, or even phosphoric acid knows that the tinning contracts on stainless steel in much about the same way as does water on an oily surface. "Epatam 3311" PLF.73/11 totally eliminates this trouble and perfect wetting by the tin (or tinning) is achieved.

Trial 1-lb. packs are available: 40/60 tin/lead, 9s. 3d.; 60/40 tin/lead, 9s. 9d.; pure tin content, 12s. 6d. from the manufacturers.

E. J. STOKOE describes an electrically-driven model of HMS Hood and makes a plea for a new type of sailing pond

A modern 'Old Timer'

THIS model of HMS *Hood*, the famous battle-cruiser, once the world's largest warship, was built from an old blueprint supplemented by information from *Jane's Fighting Ships* and various photographs.

The length of the model is $42\frac{1}{2}$ in., built to a scale of $1/10$ in. = 2 ft. It is a working model carrying more detail than is usual in craft that have to stand salt water and the buffeting of tidal bathing pools as this one has done—since Cape Town does not yet possess a proper model-yacht pond.

Except for the motor, all the fittings were home-made. The hull, of Oregon pine, was carved from the solid, with anti-torpedo bulges streamlined into it. The decks are of sycamore; the superstructure both sycamore and aluminium and the guns and turrets, which swivel, wood.

Most of the small items, such as the guns and boats (which include steam pinnaces and motorboats), were made from wood, using a knife and file. The tripods, too, are of wood, but the masts and yards were shaped from metal.

The ship is electrically driven, with a home-made gearbox.

The two propellers have bevel gears and are driven from the same motor. The continuous-action plunger switch is located on the after part of the superstructure and four units of size D torch batteries—six to nine volts—are used.

This model has sailed forty-five minutes non-stop in local bathing pools and was fitted with an underwater spring rod bumper to prevent damage to the bows on hitting the sides.

My carrying-case (also home-made) might interest other modellers who have to carry their ships long distances. The case is of thin three-ply wood on light wooden frames, with straps fixed inside to go round the hull to secure the model. It also contains a removable stand for use at side of pool.

It is interesting to recall that *Hood* was the culmination of the battle-cruiser class, which consisted of fast super-cruisers, rated as capital ships. They were evolved soon after the introduction by Admiral "Jackie" Fisher of the Dreadnought type of battleships which revolutionised warship design in the early 1900s, but the earlier battle-cruisers were mostly much smaller than *Hood* and mounted 12 in. guns.

The idea was to give them the speed

to hunt down and sink any commerce raider or cruiser on the oceans, outranging her with their heavier battle-ship-size guns; but to achieve this speed it was necessary to reduce the weight of armoured decks.

Thus the battle-cruiser was at a great disadvantage if she closed and engaged a battleship which, though only her equal in gun power and range, would have much heavier armour, especially deck armour (several decks down) to protect her from plunging fire.

The battle-cruiser type was vindicated in the victory of Sturdee's *Invincible* and *Inflexible* over Von Spee's cruisers at the Falkland Islands battle, which saved Cape Town and the South-West Africa transports early

aircraft carriers, probably the capital ships of the future.

POND OF THE FUTURE

A large model ship pond, suitable for working and sailing models of all types and periods, would be a great asset to Cape Town, and if it were large enough for model yacht racing under international rules, it might become as popular as London's famous Kensington Round Pond.

But it would have to be modern, and on the grand scale with sides built-up rather than dug down, thus bringing models, when close-in, nearer to eye level. It would also make handling easier.

Built-up ponds are easier to drain and clean out, and they are safer; people cannot fall upwards into them unless they try!

Such a pond would probably have to be at least $3\frac{1}{2}$ ft deep, to avoid the delaying suction effect of the shallower ponds on the larger model craft.



The author's model of the ill-fated battleship

in World War I, and the armour weakness, which had to be accepted in this type, was illustrated in the losses of some of Beatty's battle-cruisers which pursued and engaged the enemy's more heavily armoured battleships in the North Sea later in the war (though flashback to magazines in turrets which were hit was partly responsible).

Hood was lost for a similar reason in World War II—engaging battleships which naturally had armour superior to her own. It had been intended to strengthen the armour of the 20-year-old battle-cruiser and virtually turn her into a battleship, capable of taking her place in the line, but the modifications had not been completed when war came.

Her last salvo was seen to hit the enemy at the same moment as the enemy's salvo caused her to explode.

These big ships—battleships and battle-cruisers—are now passing into history (or "mothball" reserve) and their place is being taken by large

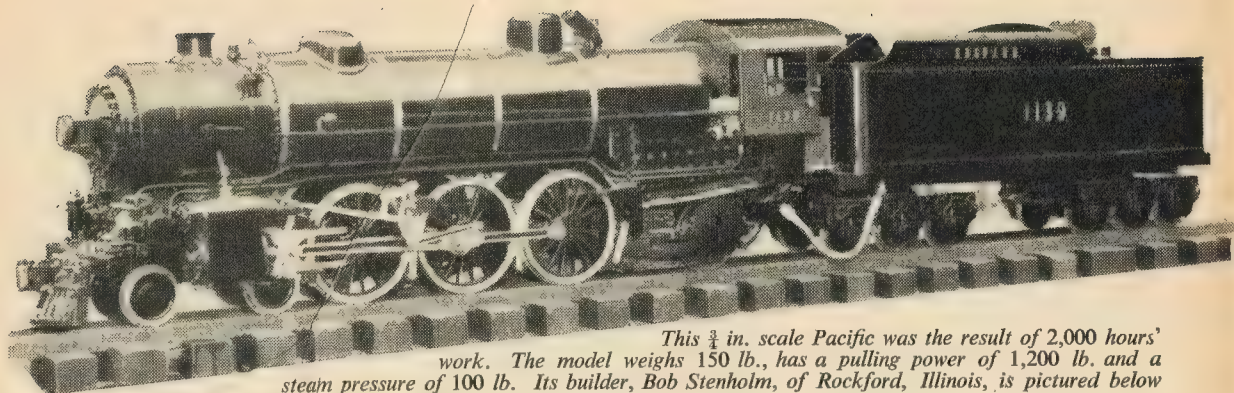
Cape Town's need

It may seem rather superfluous to say this, but model ship enthusiasts will appreciate the truth of the remarks in the Ship's Log (*Ships and Ship Models*, August 1956) about the difficulty of convincing local authorities of the capabilities and requirements of model craft. The official mind does not seem able to discriminate between toy boats and masterpieces of design and construction.

Bathing pools, paddling pools and general-purpose pools are unsuitable for the sailing of model ships.

Cape Town, with its world-famous seaport, newly acquired naval bases and expanding South African Navy, might appropriately give a lead in providing an instructive, entertaining and ornamental amenity.

This is a chance for municipal enterprise with the advice and co-operation of the various ship model and engineering clubs and societies, whose activities are at present restricted for lack of a first-class pond. ■



This $\frac{3}{4}$ in. scale Pacific was the result of 2,000 hours' work. The model weighs 150 lb., has a pulling power of 1,200 lb. and a steam pressure of 100 lb. Its builder, Bob Stenholm, of Rockford, Illinois, is pictured below



TRACK DAY IN TORONTO

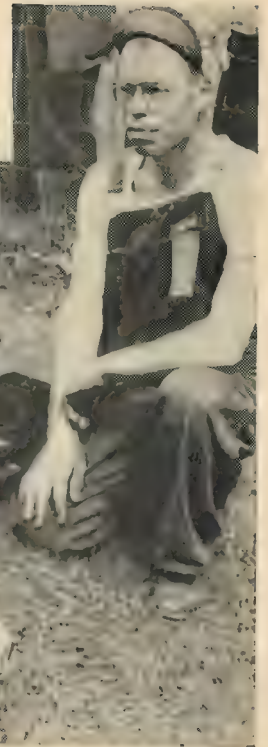
ROBERT GRAHAM records with his camera some features of the Toronto SME international event

Carl Purinton (right) of Marblehead, Mass., with his side tank switch engine. Based on JULIET, the loco weighs 45 lb., has a steam pressure of 80 lb. and can pull three people. Standing next to Mr. Purinton is John Matthews, of California

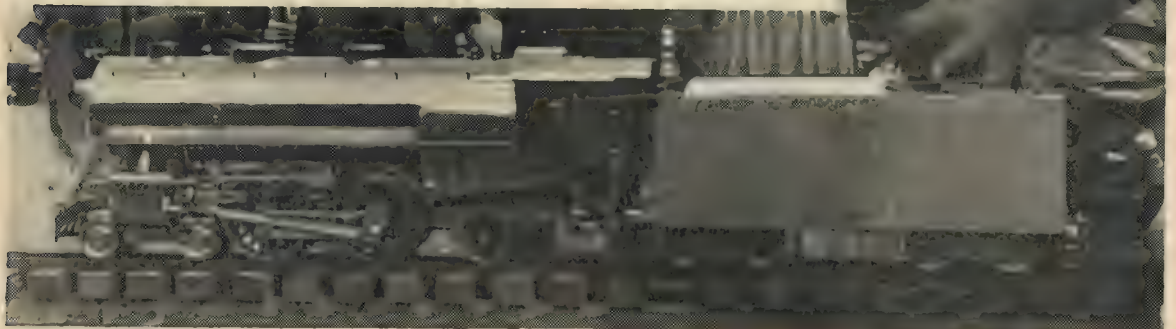
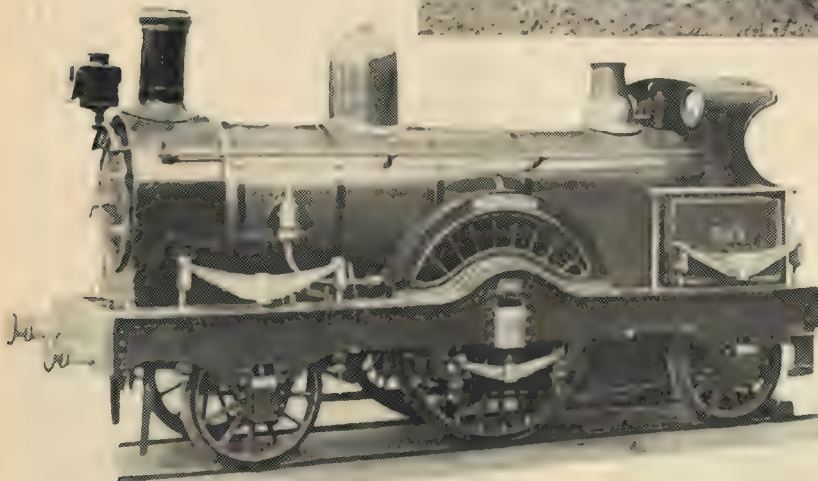




Below: Harry Allin, of Toronto SME, with his 2 in. and 1 in. scale case tractors and thrasher

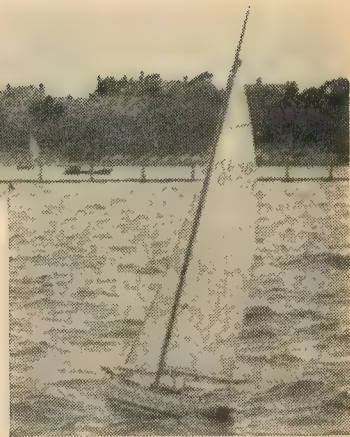


Above: Bob Johnson, of Toronto, and (below) the locomotive—based on an old Great Western type of the 1880s—built by his grandfather many years ago in England. Bottom of page: A stainless steel free-lance Atlantic





RADIO REGATTA at POOLE



There is no doubt that radio control is revolutionising yacht racing. EDWARD BOWNESS reports

THE Radio Regatta at Poole has now established itself firmly as the event of the year for the radio enthusiast in southern England. This year there was a record number of entries in most of the classes. The weather was dry throughout the two days, but there was a cool wind most of the time, which, owing to its direction, created quite a popple on the water. This slowed speeds and made steering difficult.

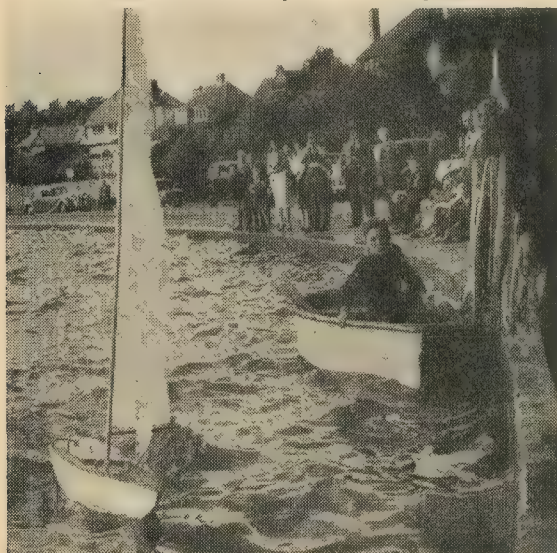
There were 25 entries for the first event, a two lap race for powered boats. Some were scratched but most had a go, in spite of the rough water. Casualties were numerous. Water got into the boats, stopping engines and putting radio gear out of action. Most boats stayed afloat, however, but only three completed the two laps. Col. Taplin's boat *Jemima* was the winner. This boat has a formidable array of batteries and a powerful motor, and put up a remarkable performance. She is not unduly large and has quite a smart appearance.

In the steering event, which followed the break for lunch, there were some good performances, the winner being Roy Martin, the new PRO for the IRCMS. Owing to the gusty weather the Novelty Competition was postponed until Sunday, so the yachts sailing under radio control took the water for the rest of the day.

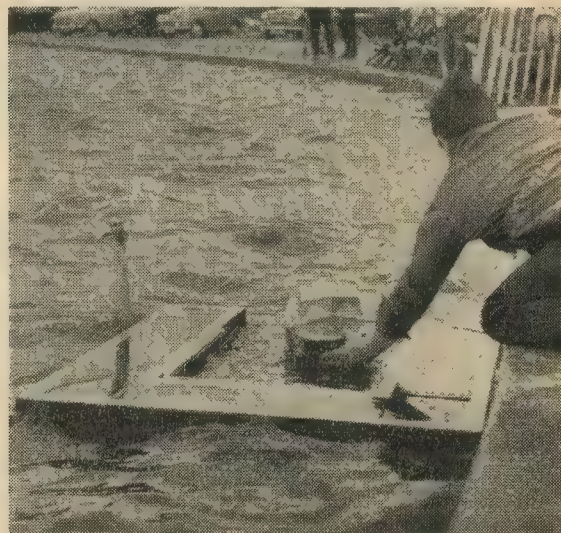
A number of experts of radio control have recently taken up model yachting, and we feel that development and progress will now be even more rapid. In this regatta we had P. Cummins, A. Tamplin, R. Curwen, and others, and all agree there is more in sailing a yacht under radio control than in operating any other type of model.

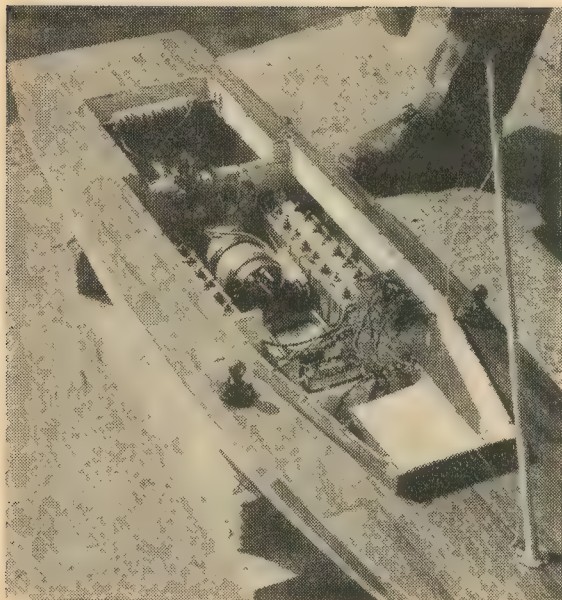
Event 4 was a handicap race for yachts of any size and the boats were sailed independently. P. Cummins

It's very convenient when your yacht comes direct to you at the finish



R. E. Martin's boat MARANTY enters the dock very neatly





The impressive power plant in Col Taplin's boat JEMIMA



J. C. Hogg with his boats SUNRAY II and ORCHID

and R. Curwen were disqualified, in each case for touching a buoy. Col. Bowden was the winner with the remarkably good time of 7 min. 1 sec. He made the three laps without a fault, and his boat sailed beautifully throughout. Mr Hogg entered both his A-class *Orchid* and his M-class *Sunray II*, but *Orchid* was overcanvassed and *Sunray* made the better time even without counting the allowance of 2 min., which was given to the smaller boat. This was the more surprising as weather conditions favoured the heavier boat.

Sunday morning provided the same conditions for wind and water as on the previous day, although at times it was a little quieter. The morning event was a steering competition for power boats, which provided some interesting sailing with the top-rankers very evenly matched. After the break for lunch we had the yachts below 50 in., mostly *Marbleheads*. Mr Hogg won the cup, which he himself had put up for this class.

The finest race of the weekend, however, was that between the larger yachts. There were six starters, four of the boats being A class. R. Curwen sailed a 10 rater, a beautiful boat and very fast. Unfortunately he failed to reach the finals. The three finalists were Messrs Cummins, Hogg and Tamplin, all with A-class boats, and a good race was anticipated. We were not disappointed; actually it was the best yacht race under radio control that I have seen, and I have seen most of them.

After two minutes jockeying for position, the boats crossed the starting line very smartly and were rather closely grouped on rounding the first buoy. In spite of a gusty wind and choppy water they kept going well, and there were some breathtaking moments lest they should touch one another. Unfortunately, at the most distant buoy, Peter Cummins seemed to lose control for a moment or two, which ultimately lost him the race. Up to that time he had been lying very favourably.

Hogg and Tamplin kept well together, and on the last leg, which was a broad reach, they had a real neck-and-neck race. Spectators were on their feet, full of excitement, and there was a great cheer when Hogg crossed the winning line with Tamplin close behind. P. Cummins had recovered his form but not his position, and came in a very creditable third.

As the wind had eased a little, it was decided to hold the Novelty Competition to conclude the day.

There were three entries. R. Martin gave a good display with his two boats, the big one towing out the small one, which was only about 12 in. long, releasing it, on which its motor started, bringing it in to the bank. The big boat carried on, burst a balloon, performed various manoeuvres, and finally came into the dock. Col. Bowden then demonstrated his 9 ft schooner, with its rotating masts and fully battened sails, all under radio control, and gave a fine display of sailing on all points.

Squadron-Leader Verney gave a good display of both steering and engine control. His radio gear was faultless, but ultimately water got to the engine and put it out of action.

At the conclusion of the day's events Mrs Millar, the wife of the president, presented the prizes in the clubhouse. Mr Simpson, the commodore, in a very happy speech, thanked the visitors for supporting the regatta, and the ladies for their valuable assistance in catering. Mr Tamplin replied on behalf of the visitors, thus concluding a very successful and enjoyable regatta.

TABLE OF RESULTS

Event I Two lap race for power boats

	Time
1 H. J. Taplin, Birchington	2 min. 26.2 sec.
2 N. W. Verney, Bedford	4 " 14.3 "
3 E. T. Poole, Wincanton	5 " 15.0 "

Event II Steering for electric boats

	Points
1 R. E. Martin, Walton-on-Thames	90
2 H. J. Taplin, Birchington	83
3 A. T. Verney, Bedford	63

Event III Novelty competition

1 R. E. Martin, Walton-on-Thames
2 C. E. Bowden, Poole
3 N. W. Verney, Bedford

Event IV Handicap sailing race for the Bravery Challenge Cup

	Time
1 C. E. Bowden, Poole	7 min. 1 sec.
2 J. C. Hogg, Poole	9 " 25.5 "
3 A. Tamplin, Chichester	10 " 20 "

Event V Steering competition for power boats, Freeman Challenge Cup

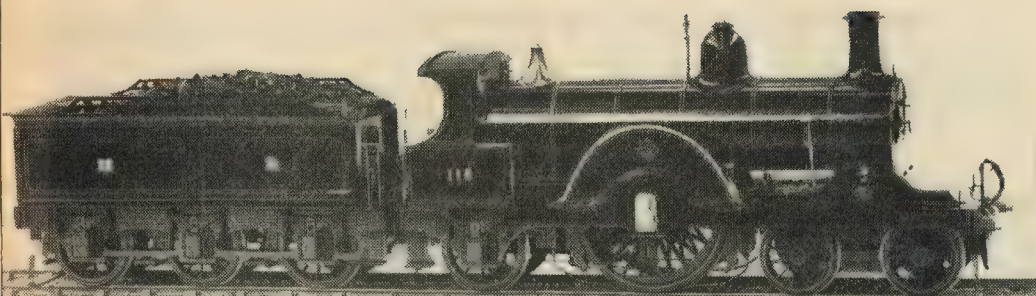
	Points
1 P. Cummins, Byfleet	153
2 H. J. Taplin, Birchington	147
3 R. M. Mogg, Wells	136

Event VI Yachts up to 50 in. for the Hogg Challenge Cup

1 J. C. Hogg, Poole

Event VII Yachts over 50 in. for the Taplin Challenge Cup

1 J. C. Hogg, Poole
2 A. Tamplin, Chichester
3 P. Cummins, Byfleet



EXHIB JUDG

A judge's lot is a happy one. MASKELYNE feels that a judge's lot will lead to a greater, a

A 7-mm. scale model of an old Midland Railway 4-2-2 engine, showing practically perfect reproduction of external lines and details, combined with excellent workmanship

THE competition section of the Model Engineer Exhibition is always the one that attracts most attention, not only from model engineers, but also from those members of the general public who visit the show.

The keen model engineer is usually very interested in comparing the other fellow's work with his own, especially when both are competing for the same prizes. The general public, as a rule, is interested simply in admiring good work and in trying to "spot the winners."

When the results of the judging have been announced, the chances are that considerable discussion will arise, and some such question as: "Why has A's model won a prize while B's, which is a much nicer-looking job, has got nothing?" It has sometimes happened that there has been considerable disagreement with the verdict of the judges in one or more classes of the competition; so some description of the way in which the judges set about their task may help to clarify some of the puzzles that often arise after the judges have finished their work.

But, first, who are the judges? They are men—or maybe women—who are, either by reputation or consent, each an acknowledged and preferably practical expert in some particular field of model engineering, and their services are given voluntarily.

Each one must be able to pass a firm and impartial judgment; but, so far as the ME and most other important model engineering exhibitions are concerned, the judges are expected to be guided by a system of awarding marks, a system introduced about ten years ago. However, if they find it more convenient the judges may in certain cases make their awards on a general assessment of merit.

The marking system referred to is based on one which I had evolved for my own use several years previously—and when I was first appointed chief judge at the ME Exhibition, I suggested that my system, or something like it, might be useful to judges generally.

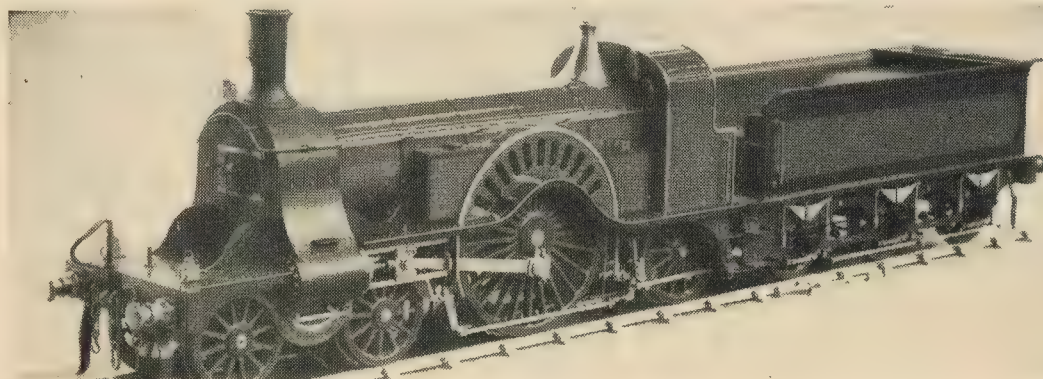
At first it worked quite well, but the very rapid improvement in the quality of competitors' work showed that some cleaning-up of the details of the system was desirable.

As a result of discussion with Mr K. N. Harris, who was then using a similar system, certain slight, but important, changes were made, and the following system was agreed to and adopted; it has been used ever since:

Each entry is judged under five headings, each of which is assigned a number of marks, thus: Workmanship and Finish 100; Quantity of Work 100; Suitability of Material 50; Fidelity 100; Design and Originality 150.

“Workmanship and Finish” simply means the *quality* of the workmanship and finish put into the exhibit by the competitor; but the judges also take into consideration the equipment available for the making of the exhibit, provided that this information has been given by the competitor in the appropriate space on his entry form. If the information is lacking, the judges are faced with some difficulty, and they cannot be blamed should they fail to give the competitor the benefit of the doubt!

"Quantity of Work" means just that, and nothing else. To cite an actual case, a model for which the competitor had made all patterns for

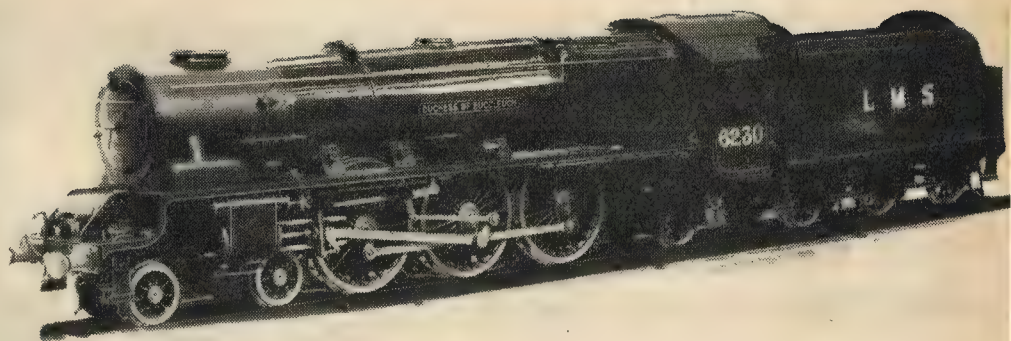


Another example of accuracy in reproduction is the painting and finished, but not the 3/4-in. scale G.N. wheeler is com to

A 5-in. gauge engine which outline and pre finished, but proved by co lining and t some details. chimney, too

ITION ING

one. Nevertheless J. N.
an insight into his work
all-round appreciation



Perfect reproduction of all external detail, first-class finish throughout and very careful fitting of all the working parts are the distinguishing features of this cup-winning 1/4-in. scale LMSR Duchess

castings would gain more marks under this heading than an identical model for which all castings were purchased.

"Suitability of Material" looks after those cases where, for some reason, materials that differ from the prototype have been used. A choice of substitute materials for certain components of a mechanical device in miniature does require a certain amount of care, thought or even ingenuity, and the judges accordingly take this into account. But they are apt to take a poor view of the man who substitutes, say, brass for steel for a crosshead.

"Fidelity" covers a fairly wide field, ranging from external accuracy of appearance to the general arrangement of details. In the case of a freelance model, no marks are normally awarded under this heading, but the explanation of this must be deferred of the next paragraph.

"Design and Originality" are included primarily for the purpose of ensuring that either the freelance worker or the man who has been obliged to depart from prototype practice or from published instructions shall receive his fair share of

marks. He can win up to a maximum of 150 marks under this heading, but forfeits the whole 100 under "Fidelity," simply because there can be, or at least should be, no prototype with which his entry can be compared.

The "prototype" model is also affected under this head; at the most it can win only half marks—75—because the design already exists in the prototype and is not involved in the construction of the model, at any stage. Yet there are frequently reasons why some departure is made from the prototype or from a published plan, and these must be considered by the judges and recognised accordingly. The result may be anything from a maximum of 75 to a minimum of 0 for "Design and Originality," so far as a "prototype" model is concerned.

The maximum total of marks that any exhibit can win under this system is 450. The actual awards, however, depend to some extent upon the general standard of the entries in the various classes, and is a matter that only the judges can decide. But, broadly speaking, an exhibit which gains a maximum of 400 or more is in the championship category and

merits the cup and/or a silver medal.

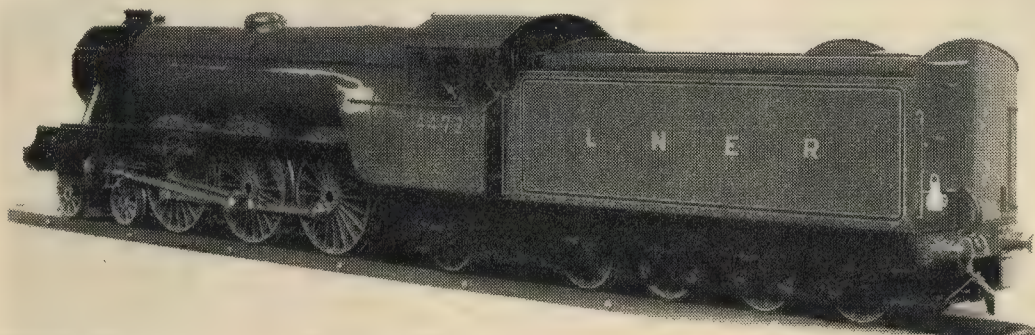
Lesser awards are usually made according to the percentages of the maximum gained by the exhibits concerned, 50 per cent (225 marks) being the lowest to qualify for an award, in the ordinary way; but the judges are free to make their own decision in this matter, taking into account all the circumstances confronting them.

This work on the part of the judges is always extremely interesting, but it cannot be hurried; no snap decisions are possible, which means that each exhibit must be carefully examined. In addition, each competitor's entry form must be scrutinised for evidence of his workshop equipment and his ability to use it, for only in this way is it possible to assess the "background" that governed the construction of the exhibit.

My colleagues and I are once more looking forward to a pleasurable session at the ME Exhibition because we believe some beautiful work will be there for us to examine and enjoy. After all, we are human and we take a great delight in this annual task with which we are privileged to be entrusted. ■

ole of meticulous
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mechanically this
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complete and ready
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LNER Pacific
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MYRMIDON

A SHIP-RIGGED SLOOP OF 22 GUNS

Part 8.—R. J. COLLINS, describing the construction of this 18th century man of war, deals in this article with the running rigging

Continued from 4 July 1957, pages 6 to 8

THE style of securing the lower ends changed during the life of the *Myrmidon*. At the beginning it was taken around the shroud and futtock stave and seized down. Later this method gave place to thimbles seized into the lower ends of the futtock shrouds and these were seized to the shroud and stave. The futtocks were served for their entire length.

There is a single tackle pendant from the topmast head and the shrouds are set up, as the lower ones. As there are an even number the pendants will have to be cut spliced to each other. Sizes: tackle pendant $3\frac{1}{2}$ in., about 8 ft. long; shrouds $4\frac{1}{2}$ in.; lanyards $2\frac{1}{2}$ in.; dead eyes medium (7 in.); ratlines 1 in.; mizen shroud 3 in.; dead eyes, small (5 in.); lanyards $1\frac{1}{2}$ in.; ratlines 34 in.

Backstays are given as a pair aside by Steele but only one on the draught. This can be paired up with the breast backstay. Sizes are the same as for the shrouds (Fig. 96). The breast backstay comes down to about 9 or 10 ft from the channel and ends with a heavy single block, throat and flat seized.

The leg of a runner is seized to the chain plate of the foremost dead eye. From there it goes to the block on the stay and down halfway to end in a single block spliced direct. This is connected to a double block secured (thimble and lashing) to the plate of another dead eye about two-thirds aft. The fall is belayed around the tackle. Stay block 10 in., runner 3 in. single and double block 7 in., fall 2 in.

Yet another stay is the shifting backstay (Fig. 97), which, as its name implies, has no regular belaying point. The stay is the same as the others but ends in a thimble about 9 or 10 ft from the channel. To the thimble is hooked an 8 in. single block which is joined by 2 in. falls to an 8 in. double. The double is stropped with a thimble and hook. It is usually belayed to a ring bolt

somewhere near the after end of the channel, but is shifted to take any special strain of the moment.

The topmast stays and preventers (Fig. 98) are put on similarly to the lower. The fore topmast stay of 5 in. passes down to the port block on the bowsprit bee and then down the side about a third of the way to be seized to a 16 in. long tackle. This is connected by a $2\frac{1}{2}$ in. fall to an 8 in. block stropped to an eye bolt in the hull close to the base of the bowsprit. The preventer stay of 4 in. leads through the starboard bee and has a 15 in. long tackle, 2 in. falls and 7 in. single block.

The main topmast stay (Fig. 99) of $5\frac{1}{2}$ in. goes down through a 15 in. block stropped to the fore masthead. From there it goes down through the lubber hole and catharpins to finish in a 16 in. long tackle about halfway down the mast. This is connected with a $2\frac{1}{2}$ in. fall to a 9 in. single block seized to a rather large ring bolt in the deck abaft the mast. The preventer stay of $4\frac{1}{2}$ in. passes through an 11 in. block stropped to the mast just below the bib. From here it proceeds as the stay, but with a 15 in. long tackle, 2 in. fall, and 7 in. block to the same ring bolt.

The mizen topmast stay (Fig. 100) has no preventer. It is $3\frac{1}{2}$ cable laid and goes to a thimble stropped to the main mast just below the bib. From here it nearly reaches the deck and ends in another thimble which is seized to the same ring bolt in the deck as the mizen stay.

Above the topmasts are the top gallants and royals. From the shoulder which marks the topmast head comes three shrouds for the fore and main and two for the mizen (Fig. 101). These shrouds differ from the others in having no dead eyes.

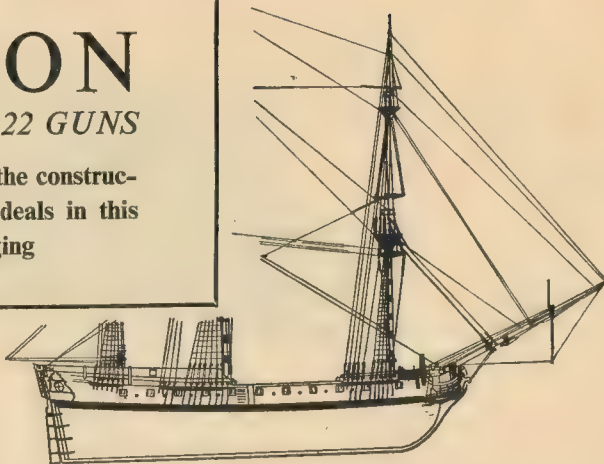
Instead they pass through the holes in the end of the cross-trees and then down inside the futtock stave and down to make off with a thimble seized to thimble at the base of the topmast dead eyes.

As with the futtock shrouds the *Myrmidon* lived from one method to another. At first the top gallant shrouds were made off to the dead eyes on the same side but later they passed over to the other side. Shrouds for the fore and main $2\frac{1}{2}$ in.; mizen $1\frac{1}{2}$ in.

A backstay goes down to the channel as for the lower masts; sizes the same as the shrouds.

Top gallant stays. The upper ends are not made fast with a loop and mouse but are spliced with a fairly light eye to prevent stepping down. In the fore (Fig. 102) it goes down to a thimble in the end of the jib boom and from there back to the starboard side, where it finishes, thimble to thimble, at the gammoning. The main (Fig. 103) comes down to a block or thimble (I use a thimble) stropped to the fore topmast head, and from there is seized, thimble to thimble, to a span from the lower trestle trees. The mizen top gallant stay, which goes straight across rather than down, is set up to the main, as that is to the fore. Fore $2\frac{1}{2}$ in., main 3 in. and mizen $1\frac{1}{2}$ in.

The last of the standing rigging is the horses for the yards (Fig. 104). These are the ropes upon which the men stand when tending the sail from the yard. It is secured to the yard arm by an eye which is spliced tight up to the stop cleats. The other end terminates in a thimble which is lashed to the back of the yard just past the far jeer cleat. For most of its length it hangs 3 ft down and is supported by stirrups which have an



eye splice or a thimble in the lower end through which it passes.

From the thimble they are served for 3 ft and from there the rope is unravelled and plaited to be wound three times around the yard and finally secured by flat-headed nails.

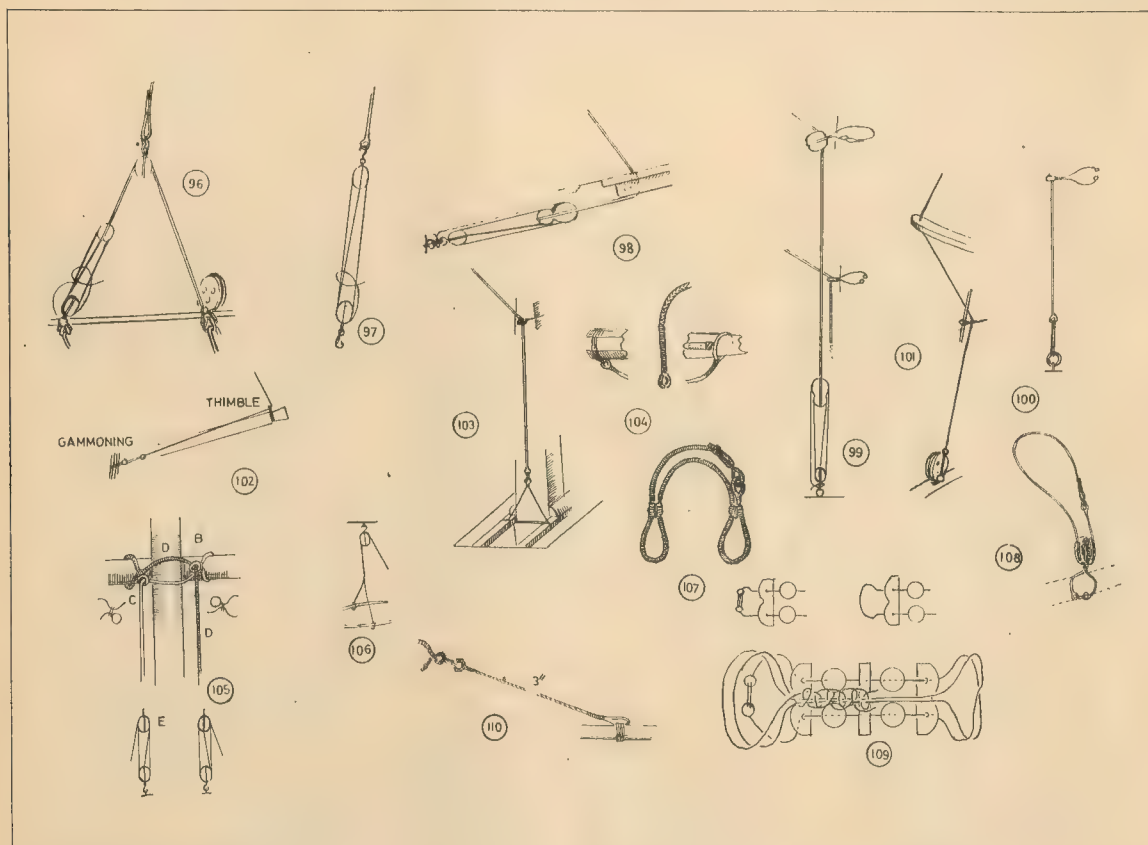
Steele mentions and shows horses for the crossjack yard but does not give them in his list. Apparently they were not always fitted. I have included them but they could be left off. Fore and main yard, 4 in., fore and main top, crossjack and sprit 3 in., fore and main top gallant,

have given place to trusses (Fig. 105), for the modeller a simpler task. Take two lengths of 5 in. rope, in length between a fifth and sixth of the yard, and work a thimble into one end of both. As for the actual fitting, I don't think I can go better than quote direct from Darcy Lever:

"An Eye and Thimble is spliced into the End of each Pendant: that on the starboard Side is put over the Yard, the End with the Eye in, being uppermost (b); and it is seized with a throat Seizing, to the standing part abaft the Yard: the End of the

leather and well greased. Darcy Lever's fall joins with a single block but Steele gives a double hooked to an eye bolt in the deck. Either would probably be correct. If you use a pair of doubles the standing end starts at the top one but if you use a double and single it starts at the single. Belay beneath the lower block.

A small, almost dainty, tackle is attached to the truss known as the nave-line (Fig. 106). A 1½ in. rope passes from the truss up to a 6 in. block slung beneath the after trestle tree and from there down to the deck.



mizen top and sprit top 2½ in., mizen top gallant 2 in.

Strictly speaking, the parrels, etc., should be included with the running rigging as there are tackles connected with them. For the building point of view, it is more convenient to place them here among the standing. In the plan numbers I start with the parrel of the sprit topsail yard but I leave it a moment here and will deal with it with the others.

Starting with the fore and main lower yards the parrels of older days

larboard Pendant (d), being *uppermost*, is reeved through the Eye of the starboard one (b), and the End of the *starboard* Pendant which is *underneath*, through the Eye of the larboard one (c) which is below also: a double Block is turned, or spliced into the End of each Pendant (e), and is joined by a Fall, to a single one, hooked, or strapped to an Eye-bolt in the Deck close to the Mast."

In the actual ship, the trusses are wormed and served and where they pass over each other are parcelled with

It could be belayed to one of the rings of the truss.

The spritsail yard is held by a 4 in. sling wormed and served for its entire length. The drawing shows the method (Fig. 107).

Parrels (Fig. 109) of the sprit topsail yard and the upper yards of the masts are quite straightforward. There are only two rows of trucks, the ribs being slightly longer than the diameter of the yard. I show how they were made up and a simplification usually used in models.

The crowjack yard was held to the mast by a truss similar to the others, but in addition had a sling. Darcy Lever shows this as a large thimble on the yard, but Steele gives a double-stopped 11 in. single block with $3\frac{1}{2}$ in. tope. I follow Steele (Fig. 108).

The sprit yard has a pair of standing lifts, one a side. A span with a thimble stropped in the bight each side is placed around the bowsprit just inside the bee. A 3 in. has a thimble worked in one end and an eye splice in the other. The eye is lashed to the yard about a quarter of the way out from the slings and the thimble lashed to the thimble on the span (Fig. 110).

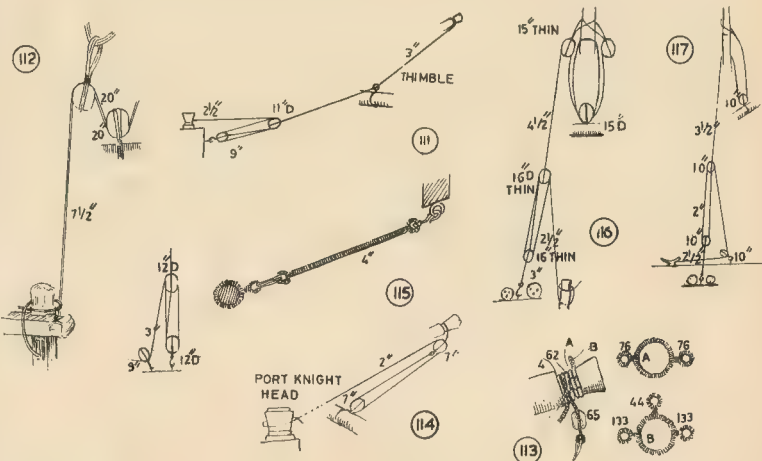
The jib guy is also a rigging line which it is hard to place, whether standing or running. I put it here as it appears more convenient so. A $3\frac{1}{2}$ in. rope is held to the end of the jib boom by an eye splice, passes aft via a thimble on the top of the sprit yard and ends in an 11 in. double block, spliced direct to the rope. A 9 in. block is hooked to an eye bolt in the bends, a little forward of the first timber head and just below the level of the top of the bowsprit.

A $2\frac{1}{2}$ in. rope starts from this block and forms a tackle with the double block on the pendant. The fall belays to the first timber head. Although Steele describes a thimble on the yard he lists a 9 in. block. I think I should use a thimble (Fig. 111).

Before we start with the running rigging make sure all the blocks are on the yards (see plan). Blocks which are hooked to the various ring or eye bolts will be mentioned as they are reached. See that the cleats are on the shrouds, as described, before the standing rigging section and finally put the following blocks on the shrouds; you will need them later. On the inside of the sixth main shroud, just below the futtock stave, there is a 6 in. single block. There is a 6 in. single block at the same level as the first, but on the after main shroud. Between the first and second topmast shrouds, both fore and main, just beneath the futtock stave, is lashed a 16 in. sister block.

Now we can get on. The first to tackle are the jeers, the heavy ropes which are used to haul up or to let down the lower yards (Fig. 112). A 20 in. single block is lashed to the centre of the yard and a similar block is slung from either side of the masthead. These side blocks have 6 in. strops, 3 ft long, and are held to the masthead by $1\frac{1}{2}$ in. lashings which pass through the cleat on the opposite side. The block itself should hang a good 6 in. free of the trestle tree.

The $7\frac{1}{2}$ in. jeer is passed through one of the upper blocks, down through the block on the yard and up to the



other upper block. From here both ends pass straight down, and I am a little puzzled about their ending. I have passed them through the inner sheave of the jeer bitts, belaying around the top.

Steele describes another method in which the jeer ends in a 12 in. double block about 4 ft. from the deck.

Another 12 in. double is hooked to the deck and the two are joined by 3 in. falls starting at the upper one. Steele does not mention any other block in his description, but his list does, and I have drawn what I think he meant. I should think that any would be correct, although I have cut out the lower blocks in my scheme. The jeers of both fore and main are the same.

I have drawn the peak of the jib boom with its sequence of ropes in Fig. 113.

With the other yards the jeers give place to halliards. For the sprit topsail yard (Fig. 114) this consists of a 2 in. rope made fast to the outer end of the jib boom, or as I have drawn it to the bottom of the outer block. From there it runs through a 7 in. single block at the centre of the yard, forward and through another 7 in. block at the end of the jib, and then back to the port-side knighthead.

It is obvious that when a ship was fully fitted the sprit-yard halliard could not be used, so it was taken in and replaced by a preventer sling (Fig. 115). This is a 4 in. rope, wormed and served, with a hook on the outer end engaged in an eye bolt at the bottom of the sprit cap and at its inner end with a thimble lashed to a thimble on the yard.

The halliards for the fore and main topmasts (Fig. 116) are more or less

similar to the jeers of the lower yards, but with a double block at the slings of the yard. A $4\frac{1}{2}$ in. tie starts at the masthead and passes down to reeve through one of the sheaves of the 15 in. double block then up through a single 15 in. thin block at the masthead and down to about 25 ft above deck level to end in a 16 in. double block.

Hooked to a ring bolt on the channel near the after end is a single 16 in. block with a strop 6 ft long. The standing end of the $2\frac{1}{2}$ in. halliard is made fast to this block and connects with the double block of the tie. The running end of the fore halliard should, according to Steele, "make off abaft the fo'c'sle" but I have belayed it to the after fo'c'sle level.

The belaying kevel for the main is a little abaft the standing end. Unfortunately, in the rigging plan, I have shown the fore and main hitched to the wrong ring bolt; the correct one can be seen to the fore of it.

The mizen yards seem to be one pace behind the others, thus the mizen topsail yard is more in keeping with the main top gallant. The tie of 3 in. (Fig. 117) is made fast to the masthead and from there passes through a 10 in. single block on the yard, back through the sheave in the masthead and down to about the level of the others to finish in a single 10 in. block.

A long, stropped thin 10 in. block is hooked to a bolt in the after end of the channel and joins the tie with a 2 in. fall. This leads to a 10 in. block on the deck just inside, and belays off to a deck cleat aft of this. Note that the mizen halliard is on the starboard side only.

● To be continued

ZOE

This week LBSC gives instructions for making and erecting the rest of the valve gear for the 1 $\frac{3}{4}$ in. gauge locomotive

(Continued from 25 July 1957, pages 126 to 128)

At the school which I attended when a small child our teacher knocked the fearfulness out of awe-inspiring long words by dissecting them into simple syllables and explaining their meaning.

Most beginners when seeing a drawing of a full set of Walschaerts valve gear assembled and erected get the impression that it is a terribly difficult job to tackle, but such is not the case. If they take a look at the drawings of the separate components they will soon be reassured because all the bits and pieces can easily be made by anybody possessing the average ability to use drill and file, and the assembly is just a piece of cake.

The expansion links are simply a matter of careful drilling and filing. Although I have the necessary equipment to machine slots and mill to outline, I usually make my links by hand. I can do the job in less time than it would take to set up, in the case of a single pair.

In the present instance, the outline should be marked off on a piece of $\frac{1}{8}$ in. steel; the best kind is the fine-grade cast steel used for gauge-making and known in the trade as ground flat stock. If not available, use ordinary bright mild steel. If the metal is coated with marking-out fluid, the lines will show up well and make the job easier.

Drill a few 5/32 in. holes along the centre line of the curved slot, as close together as possible, and open them into a slot with a rat-tail file. Then with a small half-round file enlarge the slot, keeping carefully to the marked lines, until a piece of $\frac{3}{8}$ in. round silver steel will slide from one end to the other—freely but without any shake. The ends of the slot can be finished with a small square file. Then saw and file the link to outline, and drill the hole in the tail which must go through dead square. Always cut the slot first; it would be just too bad to take infinite pains to file up a perfectly-formed link and spoil it with an imperfect slot!

The trunnion and block can be made in one piece. Chuck a short bit of $\frac{5}{8}$ in. $\times$ $\frac{1}{4}$ in. mild steel truly in the four-jaw, face the end and turn $\frac{1}{4}$ in. length to $\frac{1}{8}$ in. dia., parting off at a bare $\frac{1}{8}$ in. from the shoulder. Reverse and rechunk in the three-jaw, and face off the oblong flange to 3/32 in. thickness.

Clamp this to one side of the link, with the pin exactly opposite the centre of the slot; it will project beyond the concave side. Drill a No 51 hole through the flange and the lug at the back of the link, countersink both sides and rivet up with a $\frac{1}{16}$ in. iron rivet or a bit of 16-gauge iron wire.

Put a little wet flux where the flange stands out on the concave side, and also at the back of the lug. Heat to bright red and touch both places with a bit of soft brass wire or a $\frac{1}{16}$ in. Sifbronze rod. Keep it outside and avoid getting any in the slot. Quench in clean cold water, clean up and file away the projecting bits of flange flush with the concave side of the link, and the lug. Also file off any of the rivet that may be standing out at either side.

An alternative way of making the trunnion and block is to drill a No 40 hole in the middle of a piece of 3/32 in. $\times$ $\frac{1}{4}$ in. mild steel $\frac{1}{2}$ in. long, and tap it $\frac{1}{8}$ in. or 5 BA. Put a few corresponding threads on the end of a piece of $\frac{1}{8}$ in. silver steel and screw it into the hole as tightly as possible.

File off flush any that projects, then part off the plain side so that $\frac{1}{4}$ in. is left to form the trunnion. Attach to link as described, and don't forget that one right-hand and one left-hand are needed. The trunnions should fit the bush in the bracket at each side, easy but without shake.

RADIUS RODS

Two pieces of 3/32 in. $\times$ $\frac{1}{4}$ in. mild steel $3\frac{3}{8}$ in. long will be needed for the radius rods. Cut the slot for the lifting-block first, as described for the slot in the expansion link; a piece of 5/32 in. square or flat steel should slide easily but without shake, from end to end. Then drill the holes,

tap those for the pins holding the die blocks and file to outline, using the filing jig mentioned last week for the eyes.

The die blocks are made from $\frac{1}{8}$ in. $\times$ $\frac{1}{4}$ in. silver steel, the longer sides being carefully filed to fit exactly in the curved slot in the expansion link. The blocks should slide freely, but with no shake whatever, from one end to the other. Drill a No 41 hole in the middle of each block and countersink it.

The pins are turned from 5/32 in. silver steel and need no detailing. When the pin is screwed right home, the die block should be free enough to turn by finger-pressure, but must not be slack. Any of the screwed part of the pin that projects beyond the rod must be filed off flush. Before fitting the die blocks to the rods harden them right out by making them red hot and plunging into cold water. The eyes and slots in the rods may also be case-hardened, with the advantage of extra resistance to wear.

Put the eye end of the rods between the forks of the combination levers—opposite the lower hole—and drive a piece of 3/32 in. silver steel through the lot, filing flush each side of the fork. The joint should be free without shake. Remember that the die blocks should be on the outside.

The expansion links can now be fitted to the bushes in the motion brackets, and the combination lever with union link and radius rod attached. These are fitted on each side, with the die blocks in the link slots, in which they should slide freely.

RETURN CRANKS

File up the return cranks from $\frac{3}{8}$ in. $\times$ $\frac{1}{8}$ in. mild steel. Be very careful when setting out the holes to have the centres exactly to the dimensions shown. The uninitiated may be surprised to learn that the centres of the return cranks on certain full-size locomotives are set out to thirty-seconds. On one particular class the exact dimension works out to four places of decimals!

Drill the holes in the larger ends with a No 14 drill and open out with

ZOE . . .

continued

the "lead" end of a $\frac{3}{16}$ in. parallel reamer to a press fit on the spigot at the end of the main crank pin. The hole in the smaller end is drilled No 43 and slightly countersunk.

Turn up the pin from $\frac{1}{8}$ in. round silver steel and leave the plain end, which should be a press fit in the hole in the crank, $\frac{5}{32}$ in. long. After pressing in—don't forget to put a brass nut on the thread while doing that job to prevent damage to the threads—rivet the projection into the countersink and file flush. Put the cranks on the pins as near as you can to their correct position by eye; they should lead the main cranks when the wheels are turning in the forward direction, as shown in the general arrangement drawing of the valve gear.

To set them in the exact position proceed as follows:

First set the main crank on front dead centre, with the crosshead as near to the cylinder as possible and the connecting and coupling rods in line. Then move the expansion link into its middle position so that the die block can be run from one end of the slot to the other without moving the combination lever or valve spindle.

Fix it temporarily in this position so that it cannot shift. Next, with a pair of dividers, take the distance from the centre of the hole in the link tail to the middle of the pin in the return crank.

Now carefully turn the wheels to back dead centre, with the crosshead at the extreme end of its travel. Apply the dividers to the link tail and return crank pin again. If the centres are at exactly the same distance it will be a miracle, and you needn't do anything further; but, if not, shift the return crank so that the pin moves half the difference between its actual distance from the link tail and that shown by the dividers. Then reset the dividers and have another go. Usually it takes about three shots to do the trick.

When the distance between the middle of the hole in the link tail and the centre of the return crank pin tallies exactly with the main crank on either front or back dead centres the return crank is correctly set and—very important this—the distance *between the divider points* will indicate *the exact centres of the eccentric rod*. Don't alter the setting on any account, but when marking out the eccentric

rod use them just as they are to set out the centres of the bushed end and the fork.

To prevent the return crank from shifting when once correctly set, drill a No 43 hole about $\frac{3}{16}$ in. deep, half in the crank and half in the main crank pin, indicated by the dotted circle in the drawing. Squeeze a piece of 3/32 in. silver steel into this and file flush.

ECCENTRIC RODS

The eccentric rods are made from $2\frac{1}{2}$ in. lengths of $\frac{1}{4}$ in. $\times$ $\frac{3}{8}$ in. mild steel. Mark off to the outline shown, using the dividers set as mentioned to locate the exact centres. Drill both ends with No 41 drill and slot the forked end the same as the combination lever and mill or file away each side of the rod to the dimensions shown. The end can be filed to shape, using a filing jig to guide the file on the radiused part.

Open out the hole with a $\frac{3}{16}$ in. drill and turn up a bush to a press fit in it from a bit of $\frac{1}{2}$ in. drawn bronze. Leave the flange $1/32$ in. thick and ream it after pressing in otherwise the pressing may close up the hole. Drill a No 55 hole down the oil box, right through the bush into the bearing hole for oiling.

When erecting, attach the forked end to the link tail with a pin made from a bit of 3/32 in. silver steel screwed at both ends and furnished with commercial nuts. When both nuts are tight the pin should be free to turn otherwise the fork will grip the link tail and cause excessive

friction. Put a washer made from a slice of bronze rod a bare 1/32 in. thick, drilled No 30, between the end of the rod and the return crank to keep the rod clear of the crank when working and to ensure correct alignment with the link.

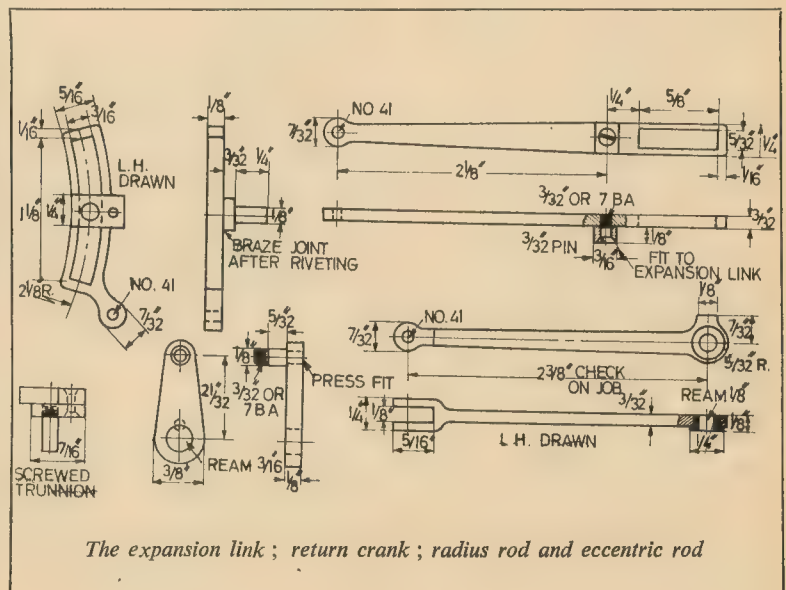
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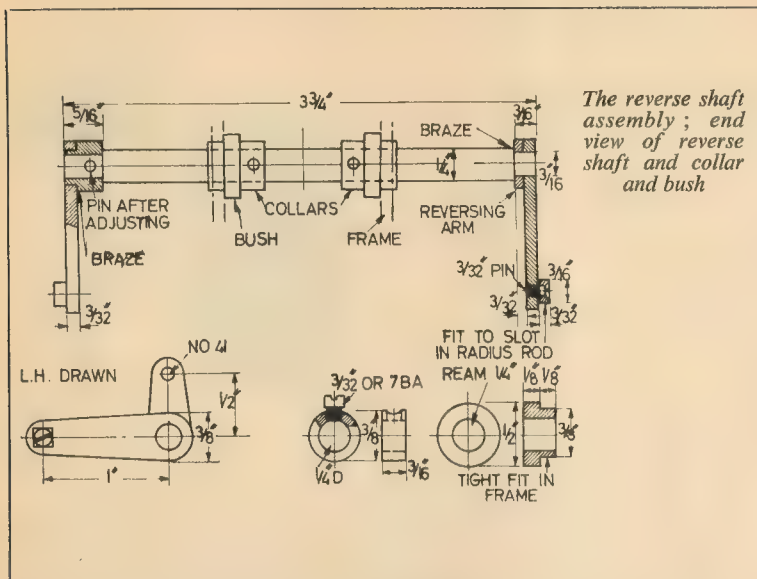
The reverse shaft is a piece of $\frac{1}{4}$ in. round steel faced off at each end to an overall length of $3\frac{3}{4}$ in. One end is turned down to $\frac{3}{16}$ in. dia. for $\frac{5}{16}$ in. length and the other to $\frac{3}{16}$ in. length.

All the arms are filed up from $\frac{3}{8}$ in. $\times$ 3/32 in. mild steel. The reversing arm and the left-hand lifting arm are plain, but the right-hand lifting arm has a boss. Drill the hole in the larger end with $\frac{1}{4}$ in. drill. Chuck a piece of $\frac{3}{8}$ in. round steel in the three-jaw, face off, centre, and drill to $\frac{3}{8}$ in. depth with No 14 drill.

Turn down $\frac{3}{32}$ in. of the end to a very tight fit in the hole in the arm and part off at $\frac{7}{32}$ in. from the shoulder. Press the spigot into the hole in the arm and braze or silver solder it. Beginners should be used to little brazing and silver soldering jobs by now! Put a $\frac{3}{16}$ in. reamer through the boss just sufficiently to allow it to go on the turned-down end of the shaft very tightly.

The smaller end of the reversing arm is drilled No 41 and the smaller ends of the lifting arms are drilled No 48 and tapped 3/32 in. or 7 BA. Die blocks to engage in the slots in the radius rods are fitted to these in exactly the same way as the die blocks





on the radius rods; but as the slots are straight, the die blocks can be made from 5/32 in. lengths of $\frac{7}{16}$ in. $\times$ 3/32 in. silver steel, drilled No 41 and countersunk for the pins. These are made from 5/32 in. round silver steel as before, and when right home the die blocks should be quite free to turn on them.

Press the reversing arm on the shorter turned end of the shaft and then press on the plain lifting arm, die block outwards, setting the arms at right angles; then braze the joint. Clean off all traces of burnt flux.

For the bushes, chuck a piece of $\frac{1}{2}$ in. round bronze or gunmetal rod, face the end, centre, and drill to about $\frac{3}{8}$ in. depth with a 15/64 in. drill. Turn down $\frac{3}{8}$ in. length to $\frac{3}{8}$ in. dia., which should be a tight fit in the holes in the frame. Part off at $\frac{1}{2}$ in. full from the shoulder. Repeat the process, then recheck the other way around and skim the flanges off truly. Press them into the frame holes, flanges inside frames, and put a $\frac{1}{4}$ in. parallel reamer through both at the same time.

The collars are turned from $\frac{3}{8}$ in. round rod (brass will do) chucked in the three-jaw. Face, centre, and drill to $\frac{1}{2}$ in. depth with a $\frac{1}{8}$ in. drill. Part off two $\frac{1}{16}$ in. slices. Drill a No 48 hole in the side of each, tap 3/32 in. or 7 BA and fit a short setscrew—any head you like.

To erect the shaft, push it through the bushes in the frame from the left-hand side of the engine, putting on the two collars as the shaft passes between the frames; then put the bossed reversing arm on the other end. Enter the left-hand die block in the

slot in the radius rod, then turn the other arm down and enter the die block on that side. If the natural spring of the radius rods won't allow it to enter easily do not on any account attempt to force it. Just take out the pin, remove the die block, drop the arm down until the tapped hole shows through the slot in the radius rod, then put the die block in the slot and replace the pin.

Finally, the removable lifting arm must be set exactly parallel with the one fixed to the shaft or the engine will try to emulate the legendary

American locomotive that went both ways at once. Set the reversing shaft so that the left-hand lifting arm holds the radius rod with the die block dead in the middle of the link slot.

Check the position by turning the wheels by hand; when correct, the expansion link will oscillate without moving the radius rod. Now temporarily fix the shaft in that position. What I do is to use an ordinary fork or clevis—the same as that on the valve spindle—with a setscrew in it so that it can be slipped over the top of the frame and clamped by the setscrew at any point.

A bit of 3/32 in. steel wire is screwed into the stem of the fork and the end bent at right angles. The bent end is put through the hole in the top of the reversing arm, and when adjusted to the position required the fork is slipped over the top of the frame and the setscrew tightened. The arm and, consequently, the reverse shaft are thus prevented from moving.

Now adjust the removable lifting arm until it is holding the radius rod on that side in an exactly similar position, with the die block exactly in the middle of the expansion link. Check by turning the wheels, and if the radius rod doesn't move the setting is satisfactory.

All that remains is to drill a No 43 hole clean through the boss on the lifting arm and the reverse shaft, and squeeze in a pin made from 3/32 in. silver steel. Operation of the reversing arm will then move both lifting arms and radius rods in unison, and the point of cut-off when notched up will be the same on both cylinders.

● *To be continued*

AN ELECTRONIC CONTROL UNIT for a cutting machine

AN electronic control unit to govern the cutting speed of their 36 in. universal cutting machine has been introduced by British Oxygen Gases Ltd.

The unit is known as Thyatron Control, and is placed on a wall shelf or table and connected to the machine by cables. It provides a higher standard of accuracy and quality of cutting by maintaining the drive motor at a constant speed at all settings, irrespective of any change in mechanical load.

It also enables the machine to be pre-set to an accurate cutting speed, which is then achieved immediately

from a standing start. Previously, when the initial speed adjustment was made while the cutter was in motion, an irregular start was sometimes made to the cut.

In addition, the control unit virtually eliminates speed variation, due to normal mains voltage fluctuations. With the new unit, the machine can be operated from 240, 220 or 110 v. a.c. No rectifier is needed.

No warming-up period is required for the motor with its associated speed drift, so that once the cutting speed has been selected and the motor switched on the speed remains constant until the cut has been completed.

SPRAY MIST LUBRICATION

for the small workshop

By DUPLEX

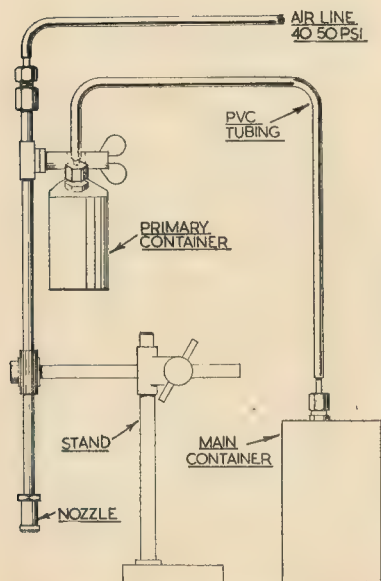


Fig. 1: Spray mist lubricator

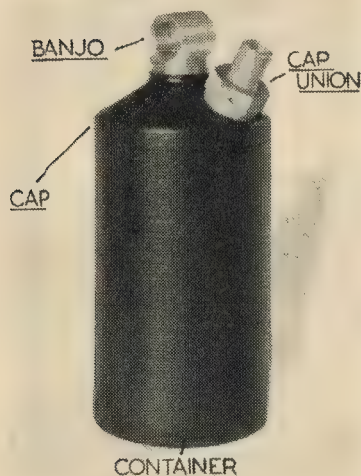


Fig. 3a: Primary container and cap

MODEL ENGINEER

IN industry a method of applying lubricant to the cutters of some types of machine tool is rapidly gaining ground. The types of machine are those where it is not possible, or is at least extremely inconvenient, to apply a normal suds system involving pumps, sumps, catch trays and the like.

In such circumstances the method now employed is to spray the lubricant directly on to the cutting tool. The form of equipment usually installed comprises one or more nozzles supplied with lubricant under pressure from a pot standing alongside the machine, and a mixing element in which the air and the lubricant can be brought together to form a light spray.

The spray so produced is used to lubricate cutters machining light alloy billets and the like. The machines in which these cutters are used are similar to woodworking routing machines and the cutters revolve at very high speed, indeed, and it is not uncommon to find that spindle speeds of 15,000 r.p.m. are being used. It is necessary, therefore, to employ some means of lubricating the work in order to avoid "drag-over" or smearing of the metal that would otherwise occur.

The simple equipment to be described was made and tested in my workshop—having been designed to be used in the manufacture of large light alloy components.

At the outset it should be explained that the reason for developing this particular form of equipment was that the existing spray lubrication systems were thought to be too wasteful. In addition, a change over from soluble oil to Shell Macron II was contemplated; this particular oil is thin and there is no need to use vast quantities of it. In fact, on all counts the less used the better since Macron II has excellent wetting properties

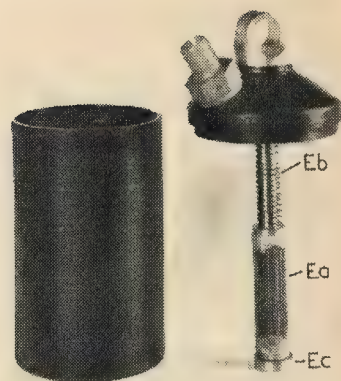


Fig. 4a: Primary container dismantled to show the suction tube and filter

and experiments have shown that only a trace of the lubricant is needed for satisfactory results.

APPLICATION

Spray lubrication has been used in the workshop for all turning and threading processes, and has been found equally effective when used on the drilling machine. It has the great advantage of comparative cleanliness since the amount of lubricant dispersed is so small.

THE APPARATUS

The apparatus (Fig. 1) consists of a complete assembly comprising the spray unit and the primary lubricant container. This assembly is connected by a $\frac{1}{8}$ in. dia. plastic pipe to the main container that may be placed in any convenient place on or around the

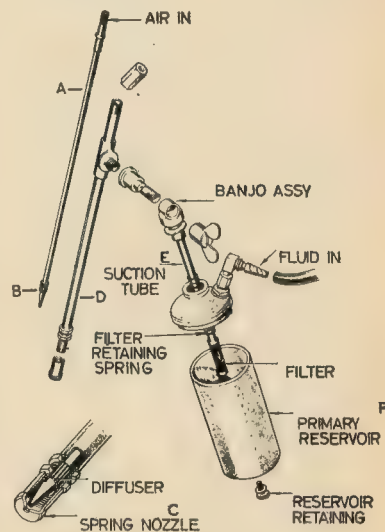


Fig. 2: Spray lubricating gun

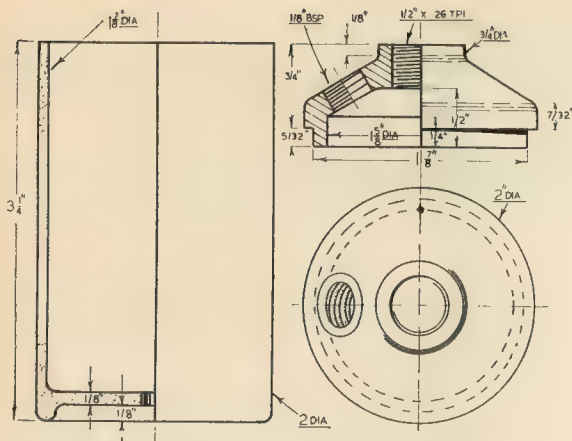


Fig. 3: Primary container and cap details

machine with which the equipment is to be used. An air-pressure system is required to operate the apparatus and should be capable of delivering air at a pressure of 40-50 p.s.i.

A higher pressure is only required if it is desired to make use of a separate main container for the lubricant. When the primary lubricant container alone is used a much lower pressure of air may be employed—say from 8-10 p.s.i.

In order to mount the equipment, some form of stand, appropriate to the type of machine, is needed. On the lathe I have used the type of stand as supplied with dial-test indicators, while on the drilling machine a special adjustable mounting has been devised and fitted to the main column of the machine. Details of these fittings will be given later.

ACTION OF THE LUBRICATOR

The action of the equipment is the same as that of the spray gun previously described. Air under pressure passing down the air tube *A* (Fig. 2) and passing out of the air jet *B* through the spray nozzle *C* builds up a depression in the fluid tube *D*, which is connected by means of the suction tube *E* to the primary container *F*. This container, in turn, is connected to the main container so that the lubricant will be drawn up and ejected under pressure through the spray nozzle.

The object of the primary container is to ensure that oil is immediately available for spraying. Tests have shown that, with all parts dry and with some 12 to 18 ft of tubing between the primary and main containers, the system will prime within five seconds of air being turned on. There is, therefore, no need to fill the primary container in the first onset.

The alphabetical order of the component parts shown in the general arrangement drawing (Fig. 2) may not necessarily be the most convenient method to follow. For this reason it may be as well to start with the construction of the primary container *F* and its attendant fittings.

THE CONTAINER

The primary container may be made from any convenient piece of scrap material and preferably from light alloy; its construction involves the greater part of the work in the whole equipment. When there is sufficient material to hand, machining from the solid is to be preferred; but this procedure is not essential, however, and the container may equally well be of built-up construction if desired.

As will have been seen, the base of the container is secured to the cover by a long hollow bolt forming the suction tube *E*.

It is best to turn the outside of the container first, using a centre in the tail-stock to support the work. When this part of the operation has been completed a fixed steady should be used to restrain the work while it is being bored out.

The cap itself presents few difficulties. The part may be machined from bar, turning the interior and register spigot first. The component may subsequently be parted off and reversed in the chuck so that the outside and the threaded seating for the T-piece can be formed.

The suction tube is simply a length of $\frac{1}{4}$ in. dia. steel tubing or in default a piece of $\frac{1}{4}$ in. dia. steel rod drilled $\frac{3}{16}$ in. dia. One end of this tube is threaded $\frac{1}{4}$ in. $\times$ 40 t.p.i. externally so that it may screw into the banjo forming part of the swivelling union.

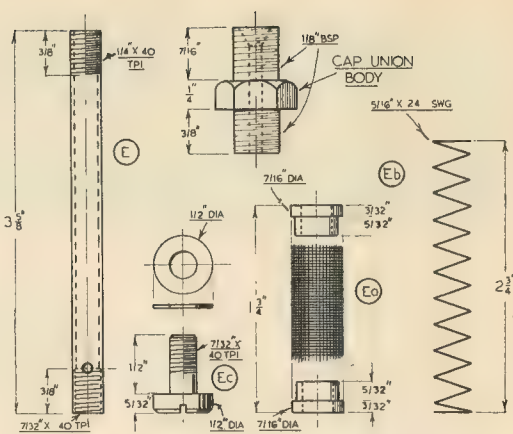


Fig. 4: Details of the suction tube and filter



Fig. 5: The equipment in place on the lathe

The bore of the opposite end of the tube is tapped 7/32 in. $\times$ 40 t.p.i. to take the screw used to secure the two parts of the container together.

● *To be continued*

BELT DRIVES

• *Belt Drives in the Small Workshop* by Duplex is a small useful book dealing with light transmission belts in all forms suitable for small power. It costs 3s. 6d. plus 3d. postage if ordered from the publishers, Percival Marshall and Co. Ltd, 19-20 Noel Street, London, W1 (USA and Canada \$1.00).

MPB REGATTAS

WELLING Regatta was held recently at Belvedere, and the lake used was set in a natural bowl, which provided spectators with a good view of the proceedings. This, with the good weather, gave enjoyment to a large crowd of onlookers.

The Erith Council fills the pond with fresh water especially for the occasion. The juvenile population from miles around flocked to the pond and in order to provide a counter attraction the Welling and District MES passenger carrying track was erected, and about 2,500 passengers were carried free during the afternoon.

The regatta began with a nomination event that was run on a triangular course in order to introduce an element of luck into the event. The winner was P. Jessop, of the Blackheath club, with nil error. J. Lockhart (Kingsmere) was second (0.1 per cent) and E. G. Matthews (Forest Gate) third.

Following this the steering event was won by E. Walker (13 pt), A. Falconer (Blackheath) was second and

E. G. Matthews (Forest Gate) third.

A relay contested between teams formed from Victoria, Barking, Blackheath, Bromley, Forest Gate, Kingsmere and Welling resulted in a win for Kingsmere, Forest Gate securing second place.

The last two items on the programme—the radio control and towing events—were run concurrently, each having half the pond in which to operate. The radio event was the same type as last year, each competitor being allowed 5 min. in which to perform as many figure eights as possible, the only restriction being that the boat had to pass in each direction through a gate of rods. This event was won by L. Wood (Forest Gate), G. Caird (Bromley) being second.

In the towing competition the entrants had to tow a fibre-glass dinghy to a buoy and then go astern a distance of 40 yd; in addition to the owner there was a passenger in the boat. This was won by G. Caird (Bromley), P. Jessop (Blackheath) being second.

During the afternoon the wives of some of the members dispensed tea and sandwiches in the canteen of the Heron Engineering Co., and thanks are due this firm for their consideration.

At the conclusion of the meeting, the Mayor of Erith, Alderman Edgar Pringle, presented the prizes and welcomed the gathering on behalf of the council.

The chairman, Mr C. A. Clark, in introducing the Mayor, thanked the Erith Council for their assistance and particularly for the trouble involved in filling the pond for the occasion.

J. A. KING.

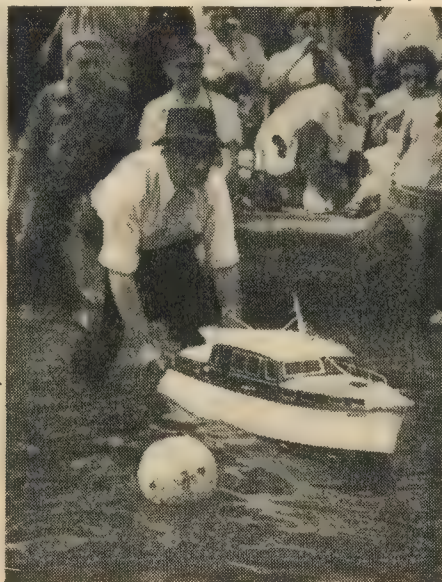
BOURNVILLE AND COVENTRY

BOURNVILLE regatta is usually a very pleasant occasion for model power boat enthusiasts, and this year proved no exception. A slightly lower attendance than normal can be partly explained by the appalling weather prevailing over much of the country. It should be recorded, however, that those who made the trip to the Valley Pool were rewarded by a fine sunny day!

The steering competition for the A. Hackett Trophy was quite keenly contested. Only one point separated the winner and two others, who tied for second place. H. Wraith (Altrincham) scored 7, R. Don (Wallasey) and E. Varey (Victoria) 6. Many reruns were required to separate the two latter competitors.

Although these scores may appear on the low side it should be mentioned

Left to right: The immaculate finish of T. Dalziel's NAIAD III gets a final polish before the B class race. Arthur Evans (Victoria) setting course in the steering competition with the motor cruiser MOIETY. RUMPUS 8 provides J. Poyser (Victoria) with a nice cool spray bath!



that the steering course at Bournville is a difficult one due to a current of water which flows across the course. This feature, combined with a fairly long course, makes high scores unlikely.

During the class A race for the Coronation Speed Trophy, Bill Morris of the home club looked well set to win with his hydroplane *Bluey*, but after several very fast laps the propeller tail shaft fractured, resulting in the loss of the propeller and preventing any further attempts.

A new class A job *Tally Ho*, by F. Waterton (St Albans), still appeared to be suffering from the teething troubles that often beset hydroplanes in the early stages of development, but it looks a promising boat. The engine has been extensively bench-tested by Mr Waterton and has attained 19,000 r.p.m. running light—an extremely high figure for a 30 c.c. engine.

Honours in the 10 c.c. classes went to Messrs Hyder and Phillips of the St Albans club, while Frank Jutton gained the D. W. Collier Trophy for class B with *Nike*. Tom Dalziel's *Naiad 3* ran nicely but failed to finish the course on any of the attempts.

COVENTRY REGATTA

It seems rather unfortunate that this event should have been fixed for the Sunday following the Bournville regatta, since for Southern enthusiasts it meant long journeys on successive weekends. Nevertheless, a number of well-known power boat exponents

made the trip and enjoyed a day at the Nauls Mill pool in glorious sunshine.

On this occasion it was decided to hold a single hydroplane event open to all classes, allowing each boat three runs, while for the straight-runners there was a steering event.

In spite of the fact that the Nauls Mill pond is sited in a natural hollow, it did not prevent a display of "aerobatics" from one or two boats when racing in the hydroplane event. One incident was a remarkable flight of about 6 ft above the water by Frank Jutton's *Nike*—luckily after completing the measured distance. Incidentally, this boat achieved one of its best regatta speeds to date—63.13 m.p.h.

R. Phillips's *Foz 2* was well in form, recording the top speed of the day, 67.18 m.p.h., thus winning the event.

Other 10 c.c. jobs were not quite so happy. Paul Wakeman's C Restricted hydroplane seems to have plenty of power, but seldom achieves a really fast time for the distance owing to the propensity of the hull to capsize. His colleague of the Bournville club, Colin Stanworth, has a new boat in action but fuel feed problems are apparent and the course could not be completed.

One 10 c.c. boat that did well was Ken Hyder's *Slipper 5*, which recorded 63.13 m.p.h. to take joint second place, tying with Frank Jutton.

Much amusement was provided by Tom Dalziel's 15 c.c. boat *Naiad 3* when fitted with a different propeller. The course was circled with a kind of

porpoising action as the tail tried to lift to the normal running angle and failed each time!

MERIDIAN.

RESULTS

BOURNVILLE

Steering Competition

1. H. Wraith (Altrincham), *Chancit*: 7 points.
2. R. Don (Wallasey), *W7*: 6 points + 3 + 1.
3. E. Valey (Victoria), *Mickey*: 6 points + 3 + 0.

500 yd Race for C. Butson Trophy—Class C

1. R. Phillips (St Albans), *Foz 2*: 63.92 m.p.h.
2. J. Jones (Altrincham), *Mambo*: 54.4 m.p.h.

500 yd Race for D. W. Collier Trophy—Class B

1. F. Jutton (Aldershot), *Nike*: 53.27 m.p.h.
2. J. Skingley (Victoria): 44.27 m.p.h.

500 yd Race for C Restricted Hydroplanes

1. K. Hyder (St Albans), *Slipper 5*: 58.19 m.p.h.
2. W. Boddy (Bristol), *Br 1*: 45.05 m.p.h.

500 yd Race for Coronation Trophy—Class A

1. J. Benson (Blackheath), *Orthon 2*: 55.58 m.p.h.
2. G. D. Noble (Bristol), *Bulrush X*: 42.44 m.p.h.

COVENTRY

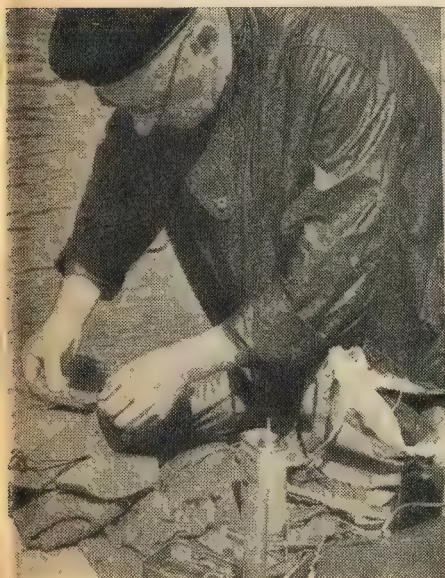
Steering Competition

1. F. Robinson (Coventry): 5 points.

Hydroplane Race open to all classes

1. R. Phillips (St Albans), *Foz 2*: 67.28 m.p.h.
2. K. Hyder (St Albans), *Slipper 5*: 63.13 m.p.h.
2. F. Jutton (Aldershot), *Nike*: 63.13 m.p.h.
4. J. Benson (Blackheath), *Orthon 2*: 56.98 m.p.h.

Left to right: J. W. Jones (Altrincham) battening down the forward hatch on MAMBO. R. Mapplebeck (St Albans) showing Ken Hyder the steam turbine plant installed in FLOOKIN. F. Jutton (Aldershot) administering the "mixture as prescribed" to NIKE



READERS' QUERIES

Do not forget the query coupon
on the last page of this issue

This free advice service is open to all readers. Queries must be on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling, cannot be given: stamped addressed envelope and query coupon with each query. Mark envelope "Query," Model Engineer, 19-20 Noel Street, London, W1.

Glass for water gauge

Could you tell me if it is possible to fit the boiler of my $1\frac{1}{2}$ in. scale road loco with $\frac{1}{8}$ in. dia. water-gauge glass; this would allow nearer scale fittings to be used. As most of the boilers described in ME use $\frac{3}{16}$ in. glass I am wondering if there is any snag in using the smaller size.—RTY, Frome, Somerset.

▲ *The $\frac{3}{16}$ in. specified is really as small as that glass should be. It has been found that any smaller diameter tends to produce inaccurate readings due to the increased affect of capillary attraction.*

Port opening

Having completed the valve gear for my $3\frac{1}{2}$ in. gauge *Netta* according to the "words and music" I am now at the point of setting the valve. However, I find that I cannot get a full port opening by approximately $1/32$ in., which means that cut-off is rather early. I would, therefore, be obliged if you would advise me how best to overcome this problem.—JD, Bideford, Devon.

▲ *It is very seldom possible with a Stephenson locomotive valve gear to obtain full port opening, but if you have made the valve gear for your engine strictly to the instructions you will find that it works quite well and has plenty of power. In fact, the point of cut off is very little affected by the amount of port opening in full gear.*

Drummond problems

My old Drummond $3\frac{1}{2}$ in. lathe has a dog-clutch arrangement for screwcutting and I am hopeful that this might be used as self act for light slow cutting-feed for machining mild steel and brass. I have tried various set ups of the change wheels but always a speed of saddle traverse results that is too fast and causes the tool to tear the metal—even if on a very light cut. The change wheels I possess are: 20, 30, 35, 38, 40, 50, 55, 60, 63 and 65, some in duplicate, and these are arranged on a two-slot wheel frame or banjo plate in the normal fashion.

Can you suggest a suitable train for the slow feed required for self act working?

Are change wheel pins sometimes

secured in the pivot slot, or do the five available pins (including mandrel and leadscrew) suffice? If this is so then surely the leadscrew would revolve in the wrong direction and cause the saddle to move towards the tail-stock.

Finally, can you advise me of the lubricant most suited to this type of lathe? I find that 3-1 oil keeps them cool, but is so thin that it needs replenishing quite often during an evening's work. I have also tried Shell BD2 (general purpose oil). This, although needing less renewal, does not keep the bearings cool; they get quite warm after an hour or so of running.—JB, Barking, Essex.

▲ *It is possible to obtain a reasonably slow self-acting feed by using a triple compound train of change wheels. The combination $20/55 \times 20/60 \times 30/65$ will give a feed of 143 turns per in. when using an 8 t.p.i. lead screw and this will be suitable for most purposes, though it is possible to obtain slower feeds by other combinations of gearing.*

As to reversal of rotation, it is assumed that your lathe is not fitted with a tumbler reversing gear to the screwcutting train. If this is so, a slotted lug is provided on the headstock casting to accommodate an additional wheel which will reverse the rotation.

The lubricating oil for a lathe mandrel should be fairly thin, but have a very high lubricating quality. (Myford Engineering Company recommend Shell Vitrea oil.) Multi-purpose oils, which are usually a compromise between various properties, are not recommended.

Slight warming up of bronze bearings is not harmful, but excessive temperature must be avoided.

The 1830 Invicta

I am interested in building a $\frac{1}{2}$ scale model of the *Invicta* locomotive, the prototype of which was made in England in 1830. Can you tell me where I might obtain drawings, castings, etc.?—ENL, Cambrian Park, Calif.

▲ *It is doubtful whether any drawings are available for this old locomotive. However, a locomotive for $3\frac{1}{2}$ in. gauge by LBSC—CANTERBURY LAMB—is very largely based upon it, and drawings can be obtained from the Percival Marshall plans department. The engine, when in steam, is extremely entertaining.*

Model trawler

I propose building a model trawler, propulsion of which I hope will be by a two-cylinder two-stroke diesel engine with scavenge air, and fitted with injectors, pumps, etc.

However, I am at a loss for a method of controlling the speed of engine, whether it is the air supply or the fuel that is metered.

It is my intention to radio control this model.—CH, Birmingham.

▲ *You do not state the size of engine you propose to make, but it is felt you would encounter considerable difficulties in developing an engine having the features stated. So far as is known no small engine of the true diesel type with fuel injection has been constructed, and the difficulties in metering very small quantities of fuel for such an engine are formidable.*

In injection engines speed and power are controlled by regulating the quantity of fuel injected, the air supply being unrestricted in all cases. But this, of course, is not practicable when the air is mixed with the fuel as in the so-called model diesel compression ignition engines, and, generally speaking, it is extremely difficult to get any flexibility of control in such engines. If you wish to get a good and reliable control of speed a petrol engine would be far more satisfactory. A two-cylinder engine of this type which has been very successfully applied to radio-control models is the Seagull engine, plans for which are obtainable from the Percival Marshall postal sales dept. The four-cylinder Seal engine is also highly popular for this purpose.

Castings for both these engines are obtainable from Craftsmanship Models Ltd., 27 Circle Gardens, Merton Park, London, SW19.

Safest for curves

What gauge and type of passenger-hauling locomotive would be best suited for a continuous line of 14 ft radius curves and straights of 50 ft?—JWW, Bexleyheath, Kent.

▲ *The smallest gauge that could safely be used is $2\frac{1}{2}$ in., and an 0-6-0 tender engine like LBSC's SOUTHERN MAID, and even a 4-6-0 PURLEY GRANGE would be suitable. Both engines are quite simple to construct.*

POST BAG

The Editor welcomes letters for these columns, but they must be brief. Photographs are invited which illustrate points of interest raised by the writer

MANDREL TROUBLE

SIR,—I started to read your journal as a child when I used to buy copies at twopence for three second hand, but never before have I burst into print. I am impelled to do so by the troubles of FM [Readers' Queries, July 4].

It is useless to attempt to straighten a mandrel once it has had a short bend of this nature, but if FM will drop me a line I may be able to assist. I have a spare mandrel of 1 in. dia., which might be skimmed down to fit. He is welcome to it, and if he will send me a sketch, however rough, of the existing one, I will, although not having much time, complete the job.

I would remind him that if the mandrel is like this the bearings will not be so hot, so he should send them along too.

I can guarantee no time limit, but will do what I can.

Lelant, Argyll Road, H. T. CORKE.
Exeter.

SIR,—I have a Myford ML4 mandrel which might fit or be adapted to cure FM's trouble. He could have same for cost of postage. 118 Auckland Road, W. VICKERS.
Darlington.

CURVED FACES

SIR,—I am indebted to Geometer for the article, "Simple Form Turning" [ME, April 25].

Up to the present I have turned convex and concave faces by first rough turning with the alternate use of both the cross and top slides, finishing with a hand turning tool.

I will, certainly, make a spring tool as described when I have occasion to turn accurately formed surfaces.

Colchester, Essex. J. E. FOSTER.

BOILER TESTS

SIR,—The query and reply to "Boiler testing" [Readers' Queries, July 11] brings to mind the subject of boiler certificates.

Approaching a club some miles distant with the request to run my 2½ in. and 3½ in. gauge locomotives over their track, I was asked to produce a boiler test certificate.

During my wanderings about the country visiting many tracks I have never seen a boiler certificate and I am sure that of all the locomotives

I have seen operating there could not be many that had passed a full Board of Trade test.

I would like to hear the views of club secretaries on this subject. What do they consider a good certificate. How is it phrased?

Any builder of small passenger hauling locomotives and traction engines would be foolish indeed to operate without testing his boiler, as specified by LBSC, but in all the articles by our old friend I have yet to read about certificates.

There is a club, many miles distant, that has given me "running rights" over their track and they have not asked for a boiler test certificate, but as I do not wish to embarrass them it would be appreciated if you would refrain from publishing my name and address.

PUZZLED.

PADDLE PROPULSION

SIR,—Looking through a batch of MODEL ENGINEERS that had piled up while I was abroad recently, I came across Vulcan's comments on paddle steamers [Smoke Rings, May 16] and I am prompted to make the following observations.

First, it appears most odd that the screw propeller, being a poor second as regards manoeuvrability, is almost invariably used especially for the

tug. Whether large screws or twin screws are fitted, the fact remains that the propelling force is at the stern, which, for manoeuvring purposes, is the worst place.

A good example of this is the comparison between a dinghy propelled by oars amidships and the same dinghy operated by an oar over the stern (sculling). There is no doubt about the ease of handling the dinghy under the former conditions.

Twin screws help to a limited extent, but this arrangement is not favoured in every quarter, possibly due to the danger of ropes and hawsers fouling the screws more readily.

One further advantage of the paddle is the more immediate grip it exerts compared to the screw propeller.

What then is the reason for the abandonment of the paddle for the screw for tugs and pleasure steamers? If the small number of old paddle tugs that have been operating for 50 years or more had any disadvantages, they would surely have been withdrawn long ago.

With regard to pleasure steamers, the tendency is, lamentably enough, to replace them by diesel craft fitted with twin screws and twin rudders (to facilitate handling at piers). These vessels lack the broad decks of the paddlers and are very prone to vibration and noise.

Glasgow, S4. JAMES M. ROBSON.



South African Railways' class 10B Pacific locomotive

MODEL ENGINEER

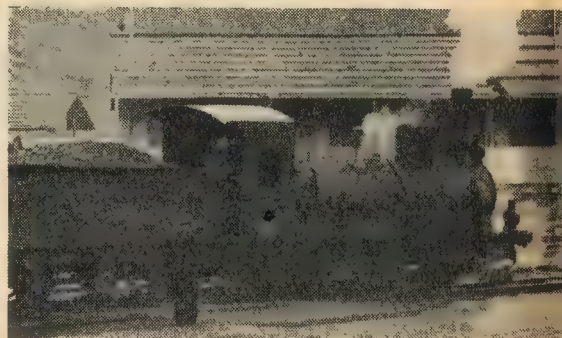


Above: SAINT COLUMBA, off Gourock (W. Lawson Kerr, Glasgow). Right: Side view of ex-showman's compound Burrell at Court Farm, Falmer, Sussex. It has recently had new gear trains fitted (C. Goldring, Brighton)



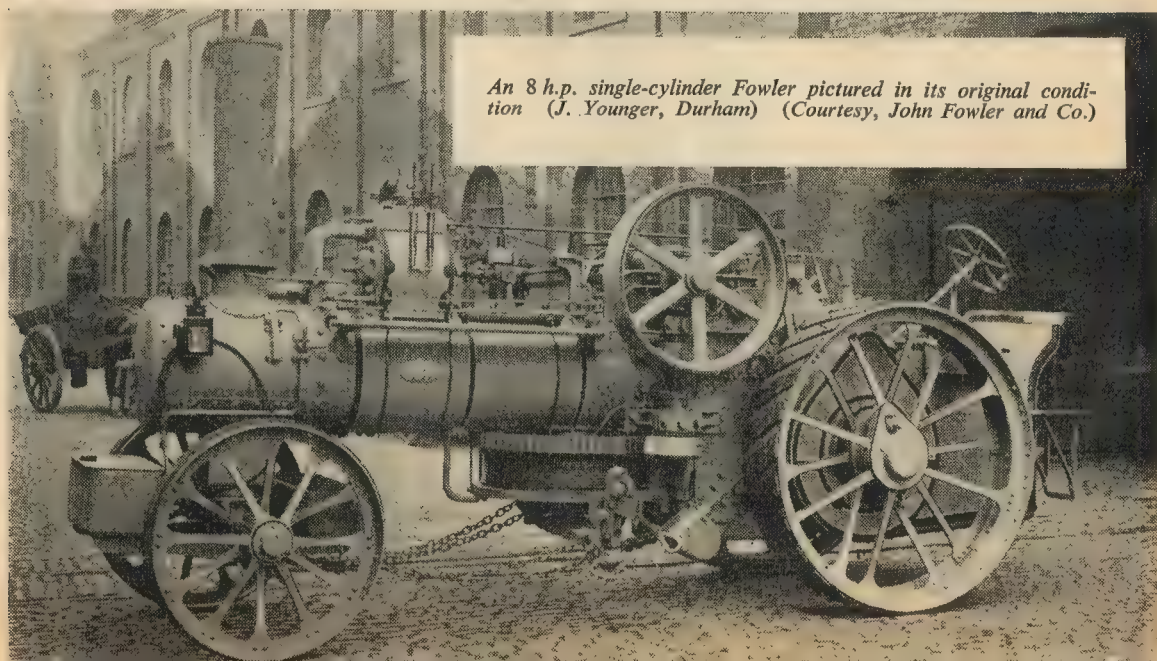
POSTBAG PICTURES

ME readers have been out and about with their cameras and provided us with this variety of interesting subjects



QUEEN MARY II fitted with a new single funnel after conversion to oil burning (W. Lawson Kerr, Glasgow)

Above: A vintage loco, slipping badly, operating in the Port Bou area (W. A. Heyden, Cornwall)



An 8 h.p. single-cylinder Fowler pictured in its original condition (J. Younger, Durham) (Courtesy, John Fowler and Co.)

POSTBAG . . .

FOWLER 16064

SIR,—Mr S. Potts, of Birmingham [Postbag, July 4], might be interested to know that Fowler 16064 is the subject of my photographs which were published in the issue April 4. Stamford, Lincs. J. T. BEATON.

MAGSLIP GEN

SIR,—In my latest copy of ME I noticed a query from GAF of Portsmouth requesting information about connecting up a magstrip unit.

Magstrips are made in 2 in. and 3 in. sizes—for 50 v. 50 cycle operation in the smaller; 50 v. 50 cycle and 20 v. 1,100 cycle in the larger kind. There are indicator magstrips, and power magstrips, and in 1944 there were some ninety-odd varieties listed as used in the Royal Navy, where some 2,000 or so are installed in ships of reasonable size, to transmit, receive and use information in the computers.

Other information engraved on the case may include such letters as FTT (*i.e.* follow through transmitter). Also the end bakelite cap will be of varying colour and will have one or two dots of varying colour, the whole constituting a colour code for easy recognition.

As an ex-Chief Electrical Artificer RN I would like to help our friend with his connections, but his data are so scant. However, as he is a Pomponian, living in the heart of the Navy, I suggest that he approaches the Naval Electrical Training establishment HMS *Collingwood* at Fareham. Otherwise Chas Austerberry, 249 West Street, Fareham, or E. R. J. Bottrill, 172 Gosport Road, Fareham, both of whom are instructors in the Electrical School, will be able to help him.

Durban, SA. JACK F. J. STEAD.

NOT RUSTY

SIR,—The recent article on rust prevention reminds me of the time I asked a countryman how he prevented his tools from rusting. He replied: "I use them." Epping, Essex. JOHN MITCHELL.

STEAM CARS

SIR,—I should like to comment on G. Egerton's letter in your issue of July 11.

This design was not intended for the engineering public. It was intended to be put before the members of the British Light Steam Power Society and was produced after a decision at

a committee meeting to get out a conversion for a popular small car with the minimum of expense and complication.

Most of the objections to this design were discussed at the meeting when it was launched and, indeed, were appreciated before it was shown to the members of the society. The existing rear axle ratio is, of course, much too low for any high speeds, as has been pointed out. It is an expensive job to replace the actual final wheel and bevel and an alternative possibility is to gear up the final drive at some point between the rear of the engine and the back axle.

The clutch can, of course, be used, but stronger springs will probably be required, at any rate for top gear starting. If the clutch is not used, then the difficulty that Mr Egerton envisages will be met with. The point about the different pistons has already been dealt with as far as the members of the society are concerned. In connection with the oil and condensate in the crankcase, the very successful Sentinel S model four-cylinder single acting engine would run an enormous mileage before any water found its way into the crankcase. When this did occur a very simple piece of apparatus allowed the water to be run off, leaving the oil. This engine used to operate at steam temperatures from

750 to 1,000 deg. F., without any trouble.

There is nothing to prevent any enthusiast arranging piston rings on the piston valves, and this will require slight modifications to the steam ports. As already explained to the members, the aim in this design was the utmost simplicity and the lowest cost and, as Mr Egerton states, the society already has a design for a double acting two cylinder compound, which is, of course, very much more expensive to build.

Finally, the public, engineering or otherwise, are not interested in the least in steam cars. A few hundred individuals, perhaps, take a passing interest in the subject, a few dozen might be interested in being shown one, especially a modern one, while the number of people who have the necessary technical ability and knowledge, money and, above all, the persistence to build or convert one can probably be counted on the fingers of one's hands.

May I add that the production of the conversion scheme discussed above was received with much interest by the members of the British Light Steam Power Society and to that extent justified the effort made on their behalf?

Ewell, Surrey. M. HARMAN LEWIS,
Chairman, British Light Steam Power Society.

2 in. SCALE TRACTION ENGINE . . .

continued from page 147

4 m.p.h. is satisfactory on very smooth surfaces, provided there are no bad road joints but refiring at this speed is apt to be a little difficult.

There is a lot to be said for running with the governor in action since it obviates almost incessant see-sawing of the throttle lever and it also combats any temptation to indulge in bursts of speed on smooth stretches.

I started the driving of this engine as a novice, in the sense that I had previously had nothing to do with coal-fired engines apart from a few minutes driving a club member's locomotive, and my experience in the matter of the best kind of coal to use may be of interest to other novices.

I find that the hard variety of anthracite gives rather poor results; the fire quickly goes dead and the smoke box very soon fills with what I imagine are unburnt particles.

What was sold to me as Welsh anthracite nuts, a considerably softer coal in pieces about as large as a small egg, gave very much better results. The fire burns brightly and

boiler pressure is easily maintained, but the smoke box still needs to be cleaned out at about hourly intervals. Genuine steam coal, which is softer still, gave still better results and practically no particles were found in the smoke box after two hours' steaming.

As a result of several runs of one mile or more over local roads, usually with a load equivalent to two adults including the driver, the fuel and water consumption works out at 1 lb. 10 oz. of coal and 1 gal. of water to the mile, and the average speed about 1½ m.p.h.

From the measured maximum drawbar pull previously given and assuming a smooth surface the maximum gradient which can be climbed with a 13 stone driver is theoretically one in six and a half, but I have not yet had the opportunity of testing the engine's capabilities on gradients of this steepness.

A few tests have been made with the winch, which is carried on the rear axle behind the nearside wheel. My spring balance was not graduated beyond 60 lb. but judging by the struggles of various people of good physique who were attached to the wire cable, I would say that the maximum pull is probably in excess of 100 lb. ■



A ship modeller's diary

By JASON

BIRMINGHAM will be there again this year. A. E. Field, twice a Championship Cup winner, tells me of their plans for this year's Model Engineer Exhibition. Donald Sanglier, a former secretary of the Birmingham Society, is submitting a Harwich Bawley. Knowing something of the vetting methods of this progressive Midlands club I anticipate great interest by those who favour coastal craft.

A hull model of the frigate *Unicorn* will give full scope to that fine wood worker, Mr Pariser. This is a largish model so for (I suspect) domestic reasons it will not be rigged. Field's own entry is a case of Severn trows. There are three Severn trows of differing periods. The maker has cleverly used the three models in one setting of a River Severn reach; one sailing, one at anchor, and one alongside a jetty handling cargo.

Research work has occupied much time and I hope that an article from his pen will tell us something of the unusual problems concerned with riparian craft up to two centuries ago. His present effort shows a Severn side quay with personnel going about their various jobs.

Unusual Sunday outing

ON July 7 Birmingham SMS and Sutton Coldfield and North Birmingham MES joined forces for a day on the canal with the difference that the members operated a tug and a canal boat, supplying skippers, navigators and engineers.

Well, I've heard of a collision between a wind-jammer and a lorry!

Maritime exhibition

KING JOHN granted a charter 750 years ago to what was little more than a fishing village and what is now the great seaport of Liverpool. Liverpool Corporation, Littlewoods, Liverpool Steamship Owners' Association, and many other bodies, decided to hold a maritime exhibition covering the period of seven and a half centuries. It consists of models, charts, navigational instruments and other maritime items.

Most of the models were professionally made for the big steamship companies. Many of the companies are today but a name to students and researchers. However, due to the good offices of the City of Liverpool Museums, there are a number of well-made models which bear not the marks of the professional model maker.

Such a model was the Mersey Flat *Pilot* of 1894, a ketch-rigged affair, extremely well made, and with the right amount of detail.

It is fortunate that men make these models otherwise all knowledge of them might disappear.

An extremely rare contemporary model was that of the *Liberty and Property* 1752, over 200 years ago. This is really a half model of a collier bark (not to be confused with barque). There was no gingerbread on such vessels. She had not been rigged; she had no masts or spars. Captain Cook knew such vessels well and he chose one to make his famous voyages round the world.

Another famous ship was represented by a half model, *The Vision* 1854. She was built by Hall, of

Aberdeen, for Beazley's, of Liverpool. Her maiden voyage—Liverpool to Hong Kong—occupied 95 days. It is said that Halls thought this the most beautiful hull ever designed. For years, no competitor's prying eyes were allowed to glimpse this half model. Her gross tonnage was scarcely more than 500.

Why does not someone in the four Merseyside boroughs turn out a West Indiaman, which was typical of the Mersey and totally different from the East Indiaman? Bristol has a few West Indiamen; they are of ample scale and well made. Why not some form of exchange, even temporarily? Liverpool started late whereas Bristol started very early, for some of her privateers are contemporary.

Incidentally, there are not many East Indiamen about. Here we must look to the London and Tyneside Museums for suitable models.

Model Engineer Exhibition

THIS is the month we've been waiting for; to meet old friends, to make new friends, and to view each other's work. The focal point naturally is the Ship Model Societies Stand.

It would be a queer question indeed which could not be answered, if not by one of the stewards, then by one of the several experts engaged upon the demonstration stands.

In connection with this I had a letter from my old friend Mr V. O. Lawson, who, I imagine, is almost unknown to the younger generation. He retired recently, but will probably be seen at the stand. His subject: models generally, but particularly early Egyptian vessels. For this he has to thank his friend who was an expert in Egyptian matters but who knew little about ships.

Perhaps Mr Lawson will have one or two of his models on the stand? He is a medallist, first chairman of the Streatham society and chairman of the pre-war Metropolitan Committee.

Models with moods

SOMETIMES, when looking at a model, I feel it expresses some mood, but whether the modeller was striving to express such a mood is difficult to say.

I remember many years ago asking Mr Money if he had tried to portray desolation in his model *The Coal Hulk*. He hadn't tried particularly but he was sorry for all down and outs, he said. If ever there were a down and out it surely must be a once proud clipper cut down to a coal hulk. I can think of scores of such models. Can you? ■



Mr Money's famous model *THE COAL HULK*—a cut-down windjammer where every detail reflects dejection and desolation

CLUB NEWS

EDITED BY THE CLUBMAN

ONE advantage of modelling is that the modeller can take his enthusiasm with him wherever he goes—and not least on holiday. If he aspires to the top of an Alp there may be a funicular railway to fascinate him; if he visits a country town there will probably be a traction engine somewhere near or a museum where some of the exhibits are in model form.

The seaside is no exception. There may be days without sunshine; there will be few without live steam—or a sail to catch the eye and the interest of the ship man.

In some holiday places of Britain this summer there are special attractions which the reader who happens to be in those towns would not like to miss.

Island models

There is, for instance, the Isle of Wight. Attractive as the sea-breeze may be on Tennyson Down, every reader who finds himself in the island towards the middle of this month will beat a track for the County Secondary Grammar School at Newport where the Isle of Wight MES is holding its exhibition.

The show will be open from August 14 to 16 and all who wish for further particulars should communicate with the exhibition secretary, A. D. Turner, of Lammas, Cambridge Road, East Cowes, IW.

It is the society's good fortune to have as president Sir Alliott Verdon-Roe, whose early aircraft models were pictured in these columns exactly half a century ago. At Rowlands Castle, in Hampshire, you may see this great pioneer of wings feeding the little birds that he loves.

HASTINGS WELCOME

As many will have noticed from the Diary, Hastings and District MES has been busy with the Carnival Week exhibition.

If all goes well, this society will soon be building a locomotive track of 3½ to 4 in. gauge on a 280 ft × 85 ft site at St Leonards-on-Sea. The proposal is for a continuous track with steaming bays. Much of the rail was already to hand when I heard from secretary P. Keller (1 Priory View, Priory Road, Hastings 6), and the society was awaiting the final settlement with the owners of the land.

Any readers who would like to use the track should write to Mr. Keller. There is, too, always a welcome for readers of this page if they happen to visit Hastings. The society arranges outings in the summer and meets monthly during the winter for film shows, talks and demonstrations.

ALL HIS OWN WORK!

Visitors to Ramsgate, similarly, will find themselves well received at the headquarters of Ramsgate and District MC—at the rear of the Fire Station in Effingham Street.

This model club is very much a local institution. Its stand at the Broadstairs Hobbies Exhibition in the Charles Dickens School was enlivened by a model racing car track and spiral railway besides having an array of members' models and handicrafts. In addition one of the members, the fertile and energetic W. C. Martin, had a stand of his own on which he displayed more than 20 of his live steam models—worked, for the occasion, by compressed air.

Not surprisingly this excellent show provided the club with a first-class local advertisement of whose effectiveness secretary E. Church (14 St Mildred's Avenue, Ramsgate) was soon made aware in requests for membership.

LIVE STEAM, PLEASE!

Although increased rates and other costs have forced Southport Model and Engineering Club into more modest headquarters (at 2a Manning Road), the life of the club continues happily.

The railways and engineering sections meet every Tuesday evening, the racing car and ships section (including radio-control) meet on the Wednesday, and there is a general meeting on the first Thursday of each month. All members may use the clubroom at any other time, including Sundays.

While the race-car track was soon operating in the new clubroom, the railway would not fit into the smaller space and so the club decided to rebuild it entirely, standardising on two-rail OO gauge.

The radio-control section has sailing rights on the local boating lake. As the lake is large, reasonably sheltered and weed-free, much interesting sailing takes place there in good weather.

All this proves that Southport has

plenty of scope and opportunity for new members, some of whom may care to join before the club holds its annual exhibition near the end of September. The three days from September 26 to 28 should see some clever craftsmanship on view at the Chapel Street Congregational Schoolroom, but secretary W. E. Harker (47 Radnor Drive, Southport) would like more live-steam models. "The live-steamers," he says, "seem to be very coy in this area."

IN AID OF SICK MINERS

Let us spare a thought, while we are enjoying the outdoor freedom of this holiday August, for those who are less fortunate.

ME DIARY

August 1 Eltham and District LS talk on Schools loco (visitors welcome). Beehive, 8 p.m.

August 2 Rochdale SMEE open meeting. North London SME extraordinary general meeting on Country Members, 8 p.m.

August 3 REC camping holiday ends. Pegben's Steam Engine Rally, Pegben Works, Elham, Canterbury, 3 p.m. MPBA of Great Britain International Regatta and St Albans Regatta, The Lake, Verulamium; practice running 2.30-6 p.m.

August 4 MPBA International Regatta, St Albans, 12.30-6 p.m.

Miners' Welfare Festival: Model engineering exhibition, Berry Hill Hall, Mansfield, Notts. (Aug. 4 and 5).

The Bedford Steam Engine Preservation Society traction engine rally (39 engines entered), Woburn Park, Beds., opening by Duke of Bedford, 2 p.m. (Secretary: John Crawley, 51 Putnoe Lane, Bedford).

IRCMS contests, Wellesbourne Aerodrome, Wellesbourne, Mountford, Stratford-upon-Avon (aircraft and land vehicles).

August 5 IRCMS contest for boats, Valley Pool, Bournville, near Birmingham (August 5 and 6).

Southend MPBC Regatta, 2.30 p.m. MPBA International Speed Regatta, St Albans, noon-6 p.m. (Not Aug. 6).

August 10 Telford Bicentenary Exhibition, Institution of Civil Engineers, Great George Street, Westminster. 10 a.m.-8 p.m. (last day).

August 11 MPBA South London radio-control regatta.

August 14 Isle of Wight MES Exhibition, County Secondary School, Newport. (August 14-17).

I am sure that wherever you are you will wish success to the 1957 Miners' Welfare Festival to be held next Sunday and Monday at Berry Hill Hall, Mansfield, by the Notts District Welfare Committee of the Coal Industry Social Welfare Organisation. Everyone who supports this festival will be helping the paralysed coal miners—the paraplegic cases which are, unfortunately, all too common in coal-mining.

The festival incorporates a model engineering exhibition with prizes in four sections: for engineering models, model boats and ships, model aircraft and general models.

Model Engineer

Classified Advertisements together with remittance should be sent to Model Engineer, 19/20, Noel Street, London, W.1, by latest Thursday morning prior to date of publication. Advertisements will be accepted from recognised sources by telephone. GERRARD 8811. Ex. 4

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WORKSHOP EQUIPMENT

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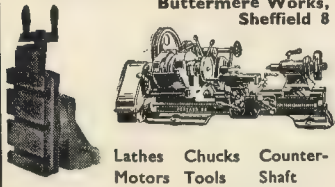
ML7 Motorised chucks, cover, etc Little used, £35, o.n.o. Buyer collects.—142, Morgan Avenue, Sheffield, 5.

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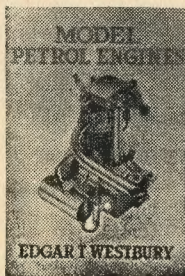
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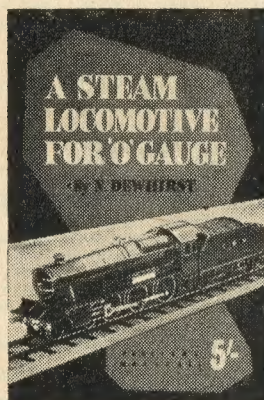
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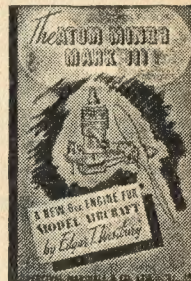
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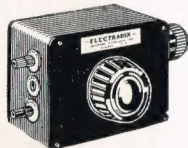
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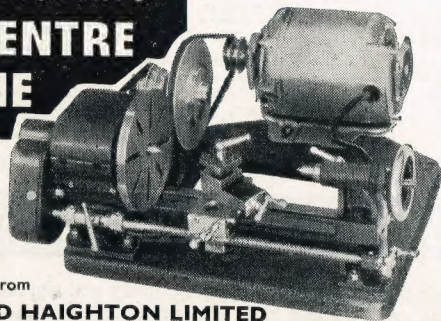
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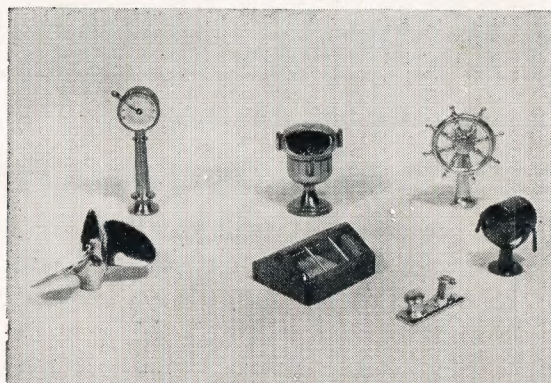
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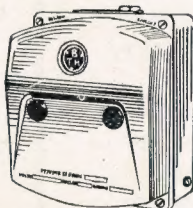


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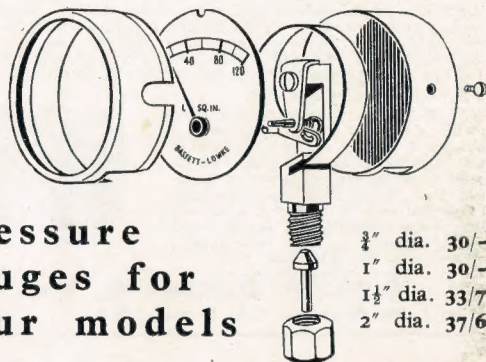


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